Franklin Institute

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS,
AND GENERAL SCIENCE.

UNDER THE PATRONAGE

OF THE

FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA.

EDITED BY DR. THOMAS P. JONES,
PROFESSOR OF MECHANICS, IN THE INSTITUTE.

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PREFACE.

In commencing this work, the Editor was aware that he had undertaken a task which would involve a considerable portion of labour; to say that this has been greater than was anticipated, would be to make a declaration, applicable to almost every human enterprise; the editor of a Journal, intended principally, to diffuse scientific knowledge among persons whose pursuits are not literary, has, however, we think, difficulties to contend with, which are more than ordinarily embarrassing. A language must, in many instances be used, which although not familiar, is at the same time the only one which will serve correctly to convey the idea to be communicated; we mean the technical language of science. To obviate this difficulty, we, at one time, proposed to accompany each number with a vocabulary, but this plan has many intrinsic difficulties, as many technical words, have no familiar analogues, and can be explained only by a dissertation upon the thing in question. We have now changed our plan, and shall, under the head of "The Artisan," give such dissertations; taking care so to frame them, as to include an explanation of all the scientific terms which we have, or may hereafter, employ.

We hope by this plan to contribute largely to the diffusion of science, among the operative classes, to whom it is calculated to be eminently useful; and thus to aid in elevating them to that station, which, from their numbers, the value of their services, and the genius of our institutions, they ought to occupy. We shall frequently explain terms at the time they are employed, but the avocations of an editor, we now know, will not always allow this to be done, even were it admitted to be desirable.

We have recently received a large number of French Journals, devoted to science and the arts, and have marked many excellent articles for translation, or abridgment, which will appear in the early numbers of our next volume. Patentees would, when their inventions are valuable, find it to their interest more frequently to furnish descriptions of their improvements.

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JULY, 1826.

On the Indian methods of working Iron and Steel, for the Damascus Gun-barrels and Sword-blades. By Capt. Michael Edward Bagnold, *of Bombay.*

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

On the Damascus Gun-barrels.

The gun-barrels made at Bombay, in imitation of Damascus, so much valued by the Orientals for the beauty of their twist, *are manufactured of iron hoops, obtained from European casks, mostly British.* The more these hoops *are corroded with rust,* they are proportionably acceptable to the workman: should there be any deficiency of this necessary oxydation, they are regularly exposed to moisture, until they are sufficiently prepared for welding. Being cut into lengths of about twelve inches, they are formed into a pile, an inch or an inch and a half high, laying the edges straight, so as not to overlap each other: a longer piece is then so fitted as to return over each end, and hold the whole together in the fire. This pile is then heated to a welding heat, and drawn out into a bar of about one inch wide, and one third of an inch thick; it is then doubled up in three or more lengths, and again welded and drawn out as before: and this operation is repeated generally to the third or fourth time, according to the degree of fineness of twist required. The bar is then to be heated about a third of its length at a time, and being struck on the edge, is flattened the contrary way to that of the stratification. This part of the operation, brings the *wire* or *vein* outwards upon the strap. The barrel is then forged in the usual way, but much more jumping* is used, than in the English method, *in order to render the twist finer.* The most careful workmen always make a practice of *covering the part exposed to the fire with a lute, composed of mud, clay, and the dung of cows or horses, in order to guard against any unnecessary oxydation of the metal.* When the barrel is completed, the twist is raised, by laying the barrel, from one to five days, either in vinegar, *or a solution of the sulphate of iron*, until the twist is raised; this process is called *the wire twist.*

To produce the *curl*, the bars or straps are drawn into bars about three quarters of an inch square, and twisted, some to the right and others to the left hand; one of each sort is then welded together, doubled up and drawn out, as before described; and, according to the skill and experience of the workman, any intricacy of twist is produced, by this drawing out, doubling and twisting.

Sometimes, to save trouble, and economise the iron thus prepared, the artist will rough file an English barrel, weld a strap of Damascus iron spirally round it, or several straps are laid longitudinally along it, and welded on. *A native artist never works with pit coal, under any consideration: charcoal from light wood, forms his only fuel.*

On the Damascus Sword-blades.

In making the sword blades, there are several methods used; some workmen make a pile of alternate layers of softer and harder cast-steel, with powdered cast-iron mixed with borax, sprinkled between each layer.† These are drawn out to one-third more than the length of the intended blade, doubled up, heated, twisted, and re-forged several times; the *twist is brought out* in the same way as that in the gun-barrels, namely, by the use of vinegar, or a solution of sulphate of iron.

Some sword-blades are forged out of two *broad* plates of steel, thus prepared, with a *narrow* plate of good iron welded between them, toward the back, and thus leaving *solid steel for the edge*, of a considerable depth.

Others prefer to make them of one plate of steel, with a lamina of iron on each side of it, to give them strength and toughness.

Swords of this description were tempered in my brother's presence, in the following compound; and, as he states, with considerable effect.

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* Or *upsetting endways*, by striking the barrel against the side of the anvil, whilst it is of a welding heat.—*Editor Tech. Rep.*

† *The soldering steel or iron with cast-iron and borax, and welding afterwards,* thus seems to be *an Eastern practice.*

The Hardening Composition.

The blade was covered with a paste, formed of equal parts of barilla, powdered egg-shells, borax, common salt, and crude soda, *heated to a moderate red heat; and just as the red was changing to a black heat, quenched in spring-water.*

From the information of the workmen, it appears that Damascus obtains all its steel from the upper part of the Deccan, where it is called *fonlode hind*, or Indian steel, of which there are great quantities, but little or no demand for it. The *Damasque* (or *joar*) is natural to this steel; and the veins in it are raised by immersing the blades in acid solutions.

On the Manufacture of Cobalt Blue.[*]

This fine colour, called from its inventor, "*Bleu de* THENARD," may be substituted for ultra marine, or the blue colour made from *lapis lazuli:* it appears to be, according to Thenard, a composition of alumine and oxide of cobalt. To prepare it, we must first procure a nitrate of cobalt; which is obtained for this purpose, by the following process.

We take the cobalt ore, which is composed of cobalt, arsenic, iron, sulphur, and a very small quantity of nickel, and having reduced this to powder, it must be calcined in a reverberatory furnace. In order to profit by the heat of this furnace, it is usual to make many successive operations; so that, after having withdrawn the calcined mineral, it may be re-charged with a fresh quantity. We must be very careful to stir it frequently during its calcination, so that every part may be successively exposed, as equally as possible, to the action of the heat. The chimney of the furnace must have a good draught; so that all the constituent principles of the mineral may be calcined, and the volatile products of the combustion, be carried off in the current produced by this draught. We thus disengage a great quantity of the oxide of arsenic, in the form of white vapours, and of sulphurous acid gas. The roasting is continued, until the arsenical vapours are no longer disengaged, which is easily ascertained as follows:—by collecting in a ladle, a little of the gas from the interior of the furnace, we find when the garlic odour of the arsenic has ceased to be given off: we then withdraw the calcined mineral from the furnace, and obtain a mixture of the oxides of cobalt, iron, and nickel; retaining in combination, arsenic in the state of oxide or acid; and mixed also with a portion of the mineral, in an unaltered state.

The operation of calcination being finished, we slightly boil the result, in an excess of weak nitrous acid, in a balloon or matrass of glass; and, after having decanted the clear supernatant liquid, we evaporate the solution, thus obtained, nearly to dryness, in a capsule of porcelain; or, perhaps, still better, of platina: we then throw this residuum into boiling water, and filter it, for the purpose of separating from the solution, the arseniate of iron, which had precipitated during the operation, and then pour into the clear liquor, a solution of sub-phosphate of soda; which, by decomposing the nitrate of cobalt, affords, instead of the soluble nitrate of soda, an insoluble phosphate of cobalt, which precipitates.

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[*] From the *Dictionnaire Technologique.*

This precipitate is of a violet colour; and is susceptible of changing to a rose colour, by remaining under water. After having well washed it, on a filter, we collect it together *whilst it is in a gelatinous form*, in order to mix it, in the most uniform manner possible, with eight times its weight of alumine (or the hydrate of alumina) *in the same state*. If the mixture has been properly made, the paste will have a perfectly uniform tint, throughout its whole mass. We then spread this mixture on smooth plates, and put them into a stove; and when it is become sufficiently dry, so as to be hard and brittle, it is pounded in a mortar, and exposed to the action of heat, in a covered earthen crucible. After being heated to a cherry red, for half an hour, we withdraw the crucible from the fire; and ought to find, on opening it, the beautiful blue colour which we purposed to obtain: which we then put, in this state, into a bottle, in order to preserve it for use.

This operation constantly succeeds, provided that we have attentively observed all the precautions pointed out; but above all, that the alumine, *in the gelatinous form*, shall have been precipitated from the alum, by a sufficient excess of ammonia; and that it has been well washed, with very pure water, (such, for instance, as shall have been obtained by filtering it through charcoal,) until it is completely purified.

We may employ, for the preparation of this colour, the arseniate of cobalt, instead of the phosphate; only observing to mix it with sixteen times its weight of alumine, instead of eight only. To obtain the arseniate of cobalt, we begin by preparing a solution of cobalt in the nitric acid, by the method which we have above described; adding to it, a solution of the arseniate of potash, until it no longer precipitates, as in the former case. The exchange between the oxides and the acids of the two salts, will take place in the same manner; and the operation will be finished, by following, in all respects, the directions we have before given.

If we also intimately mix, in the relative proportions above described, the alumine and the nitrate of cobalt,—the alum with a base of ammonia, and the nitrate of cobalt in solution in water,—evaporating the mixture to dryness, and afterwards calcining it in a crucible, we also obtain a colour analogous to the preceding; which tends to prove that the blue colour from cobalt, is merely a mixture of the oxide of cobalt and alumine. The blue colour obtained by this last process, is, however, paler than that which results from the two others. P.

On washing and cleansing Linens, &c.

TO THE EDITOR OF THE LONDON JOURNAL OF ARTS, &C.

Sir,—As the labour of washing and cleansing of linen, cotton, and other articles of wearing apparel, or furniture, forms no inconsiderable feature in the domestic business of every family, and is also a process that occurs in many manufacturing establishments, perhaps you may not think the following observations upon that subject, unworthy of a place in your Journal of useful Arts.

Being a proprietor of extensive works, connected with the manufacture of linen cloths, and a bleacher by profession, I am tolerably well acquainted with the operations of cleansing, and whitening such fabrics, and with the advantage of different processes in the accomplishment of that object; which may, perhaps, exempt me from any suspicion of ignorantly proposing methods which would be detrimental to the articles operated upon. I cannot, however, for a moment doubt, but that the female part of the community will, from early prepossessions, object to any process differing from their usual practice; yet I must be allowed to state the result of experiment, and leave the housewife to reject or adopt my plans, as she may think proper.

The number of females connected with our works, who were frequently engaged in the business of washing for their families, and the time so employed to the hindrance of our manufactory, induced me to project some plan by which this labour might be reduced, and in so doing I have been fortunate enough to confine this business to less than one-fourth the number of persons who were formerly engaged in it, and also to lessen the quantity of soap expended, as well as shorten the time of operation.

My process is this; let the articles intended to be washed, be assorted according to their qualities of fineness, and having done this, put them into different vessels containing warm water, at the temperature of about 100 or 130 Fahrenheit; in this water, dissolve about one-third or one-fourth of the soap which would be required to wash in the ordinary way, and to this a small quantity of pearl ashes must be added. The clothes being entirely covered with this liquor, let them remain in soak for thirty-six or forty-eight hours, after which, they are to be taken out of the liquor, and rinsed well in clean cold water, giving them a slight wringing, so that but little of the water may be retained in the clothes.

A boiler containing as much water as will cover the clothes, intended to be washed at one operation, is now to be heated to about 100 degrees Fahrenheit, and the remaining quantity of soap, (about two-thirds the sum used in all,) with a little pearl ashes, must now be introduced. When the soap is sufficiently dissolved, the clothes may be put into the liquor, taking care that the finer articles are all kept by themselves, and operated upon first. The temperature of the liquor must now be gradually raised to the boiling point, during a space of twenty minutes or half an hour, not faster; then let the whole boil for fifteen or twenty minutes, after which the first lot of clothes may be taken out, and deposited in a vessel containing warm water. Retaining the ley from the first boil, now fill up the vessel with water, and then introduce the next coarser kind of articles, and operate upon them as above.

The clothes thus treated are then to be carefully examined, and if any spots remain, which seldom happens, they are to be washed by the hand, giving the whole a slight rub in the common way. This process of boiling, (contrary to the common prejudice,) will so effectually dislodge every greasy and dirty part, that more than three-fourths of the business is effected without any rubbing whatever; and the clothes are ultimately rendered perfectly clean, by merely rinsing in cold water.

By these means, as I have before said, the labour and expense of washing have been greatly diminished in our establishment, and the clothes preserved from that very serious injury, which they suffer from rubbing between the hands, which separates the fibres of the threads, and destroys the fabric of the clothes, in a much greater degree than they can possibly experience by ordinary wear.

I am, Sir, yours, &c. M——

Dundee, June 26th.

An account of the mode of welding together two pieces of cast steel, or of iron and cast steel, &c. which has been successfully practised. By A. SEIBE.

TO THE EDITOR OF THE LONDON JOURNAL.

'SIR,—Having observed in your Journal, an account of welding together the edges of thin Plate Iron, and understanding that the material used as a flux, is considered to be a secret, and confined to the few persons who practice it; without knowing any thing of the materials employed at Birmingham, or in America, I beg to inform you that I have invented, and for some years practised a mode of welding together two thicknesses of cast steel, or iron and cast steel, which process of welding is performed at a temperature very little above a red heat.

'I send you herewith, several specimens of welding two pieces of cast steel together, of iron and cast steel, and of thin sheet iron alone; and also an account of the process and materials employed.

'I melt borax in an earthen vessel, (not in a metallic one, particularly brass or copper;) after melting, one-tenth of sal-ammoniac is pounded and mixed with it: the two substances being well incorporated together in the fire, it is to be poured out on to an iron plate, and when cold, will produce a substance resembling glass; it is then to be pulverized, and mixed with an equal quantity of unslaked lime, which makes it fit for use.

'In performing the operation of welding, the iron or steel must first be heated to a red heat, and then the pounded material scattered upon the surface, which will melt and run over it like sealing wax.

The iron or steel is then to be again introduced into the fire, and raised to a heat considerably below the ordinary welding heat, (which proves itself by the cast steel) when it is to be withdrawn, and immediately beaten by a hammer, until the surfaces are perfectly welded together.

'The composition is an invention of my own, and I have proved it for some years with never-failing success. Anxious to add my mite from time to time, to the advancement of the Arts, if this piece of information is considered by you as deserving a place in a scientific work, it is very much at your service, and the service of the public.

I am, Sir, Yours, &c.

AUGUSTUS SEIBE.

On the Comparative Advantages of employing Band-wheels, Spur-wheels, and Bevel-wheels, in Machinery. By Mr. JOSEPH BACKWELL, *Engineer.*

SIR,—I believe that the difference in the friction between band-wheels, spur-wheels, and bevel-wheels, has never been ascertained from actual experiment; at least, I am not acquainted with any publication on this interesting subject. The following results, which I obtained from an experiment made on purpose, will contribute, in some degree, to point out the very great advantages, and disadvantages, attending the employment of these different methods of actuating machinery. Two band-wheels of equal diameter, and mounted upon horizontal shafts 15 feet asunder, were driven by a leather band or strap, one inch broad; and I found that, by suspending a weight of four pounds to a line passing over a pulley, I could overcome the friction, and put them into motion. Two equal-sized spur-wheels, of cast-iron, with their teeth pitched, and dressed or trimmed, in the usual manner, and working into each other, at the same velocity as the two band-wheels, required five pounds weight to keep them in motion. On fitting two bevel-wheels, of cast-iron, also of equal diameters, upon two other shafts, they required a weight of seven pounds to give them a similar velocity with the others: and thus, the spur-wheels required one pound more to put them into motion, than the strap or band-wheels did; and the bevel-wheels, three pounds more.

I connected other and similar machinery to these shafts; and found the same proportional weights requisite to overcome the friction, and to put them into motion, as when they ran empty.

Of course, with other proportions, or differences in the diameters of the two wheels, the results would vary: still, the above may serve to show the comparative advantages of employing band-wheels, in preference to spur-geer; and spur-geer in preference to bevel-geer, where we have it in our power to make an election: and, in fact, *wherever bevel-wheels can be dispensed with, they ought never to be employed.* [*Tech. Rep.*

ON ENGRAVING.

(From the Mechanic's Gallery, By C. F. Partington.)

(Continued from p. 331, vol. i.)

On Copying Drawings, and using the Graver.

There are various methods by which those who are ignorant of the art of drawing, may copy, very accurately, the outlines of pictures, prints, and drawings; and these methods are often useful to those who can draw, and to engravers, when either great expedition or great accuracy is required; though none of them should ever be used by one who is learning to draw.

To trace against the light, hold the drawing you wish to copy against one of the panes of the window, or have a pane of glass put in a frame, and fitted up like a music stand, with a candle behind it. Lay your paper over the drawing, and you will see all the lines of the original distinctly through it, by which means you can easily trace them with a pen or black-lead pencil.*

The following simple instructions will sufficiently explain the mode of enlarging and contracting by squares.

Divide the sides of your original with a pair of compasses into any number of equal-parts, and rule lines across with a black-lead pencil from side to side, and from top to bottom. Then having your paper of the size you intend, divide it into the same number of squares, either larger or less, as you would enlarge or contract it. Then placing your original before you, draw, square by square, the several parts, observing to make the part of the figure you are drawing fall in the same part of the squares in the copy as it does in your original. To prevent mistakes, number the squares both of the original and copy. This method is much used by engravers.

To prevent the necessity of ruling across the original, which in some cases may injure it, take a square pane of crown glass, and divide its sides, and also its top and bottom, into equal parts: then from each division draw lines across the glass with lamp-black ground with gum-water, and you will divide the glass into squares. Then lay the glass upon the original which you wish to copy, and having drawn the same number of squares upon your paper, proceed to copy into each square on your paper what appears behind each corresponding square of the glass. Instead of a glass, an open frame with threads stretched across will answer the same purpose.

The different kinds of engraving on copper may be thus briefly enumerated.

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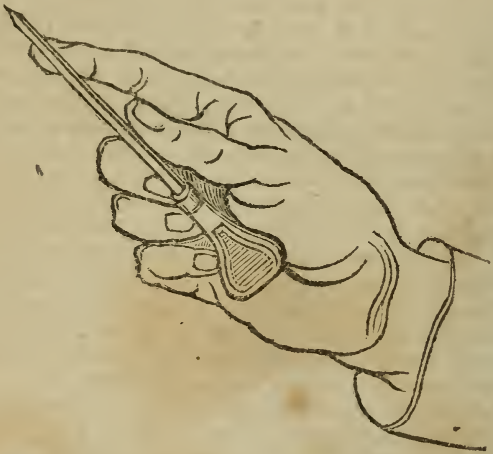
* To make tracing paper, mix together equal parts of oil of turpentine and drying-oil, and with a rag rub it evenly over some tissue-paper, or any other very thin paper. Hang it by to dry for a day or two, and it will be fit for use. Lay this over the print or drawing you intend to copy, and you will see every line distinctly through, so that you can go over them with the black-lead pencil. If you wish to do it in ink, you must mix a little ox's gall with the ink, to make the paper take it, which it would not otherwise do on account of the oil.

1. Engraving in strokes with a point, the copper-plate being covered with a ground, and the strokes afterwards corroded with aqua fortis. 2. In strokes, with the graver alone, unassisted by aqua fortis. In this instance the design is traced with the dry point (which is a sharp tool) upon the plate, and the strokes are cut in the copper by the graver. This is generally called engraving with the tool and dry point, only. 3. In strokes, but which are first etched with aqua fortis, and then finished with the graver: by which the two former methods are united. This mode is the most universally practised, and has also the best effect. 4. In dots, without strokes, which are performed with the point upon the wax or ground, and then bitten-in with aqua fortis, as in etching; but they are afterwards harmonized and softened with the graver, by making several small additional dots between them. Sometimes this mode of engraving is effected with the graver only, unassisted by the point, which is very often the case in the flesh, and the finer parts of portraits. 5. In dots, which are first etched as the foregoing, but afterwards harmonized by the dry point, performed by a little hammer, instead of the graver. This operation is called *opus mallei*, or the work of the hammer. It was practised by Lutma and others, but is now nearly exploded. 6. In mezzotinto, which is performed by covering the plate with a strong dark ground, or deep shade, by means of a toothed tool, and corroding the dots with aqua fortis. The parts which are to be light, are then rendered more or less smooth, by the scraper, according to the degrees of light they are to represent. 7. In aqua tinta, which is a newly invented method of engraving, but has suddenly attained a degree of perfection seldom the lot of recent discoveries, the outline is first etched, and the plate afterwards corroded; but in a different manner from either etching or mezzotinto, as will be explained hereafter.

The surface of the copper-plate designed to be engraved, should be perfectly polished, very level, and free from every imperfection. When the plate is ready, the next point is to transfer to it an exact copy of the outlines of the design to be executed. For this purpose, heat the plate in an oven, or hold it over one or more candles, till it will melt white wax, a piece of which should then be rubbed over it, and allowed to spread till it forms a thin uniform coat over the whole surface; after which, the plate may be left upon a table, till it is cool. In the mean time, take a piece of transparent paper, and fastening it upon the original design, in the usual manner for tracing, draw the whole of the outlines in the most accurate manner, with a black-lead pencil. The outline thus sketched, may be turned down upon the white wax, with which the plate is coated, and upon its being subjected to the action of a press, such as is used for packing, or kept between several thicknesses of paper, under a heavy weight, for an hour or two, on taking it out, the lines on the transparent paper will be nearly eradicated, but a lively copy of them will be found transferred to the white wax on the plate, in the reversed position, which is necessary to make an impression of the finished plate, resemble the original. The pencil marks on the wax, being now traced with a fine steel point, so as just to touch the copper, the wax may be melted off, and a perfect outline of the design, will be found on the plate. When any small, subordinate part of a design, is to be transferred to the plate, the process is the same, except that the transparent paper is merely held down on the plate, and rubbed on the back with the burnisher instead of pressing.

It is now necessary to use the graver, the knob of the handle of which should rest against the hollow of the hand, the fore-finger extended towards the point, the thumb on one side, and three fingers on the other, in such a manner that the graver may be applied flatly to the plate, pressed forward with greater or less force, or wholly stopped, as occasion requires, in any part of its progress. The annexed engraving may, however, best illustrate the operation.



In forming straight lines, the plate should lie steadily upon the cushion; in forming curved lines, sometimes the plate only must be moved, while the graver is held steady; at other times both the graver and plate must be moved, according as the artist finds he can with most freedom, produce the desired effect. The graver raises a slight bur on the sides of the strokes; these must be removed by the dexterous use of the scraper, which must be prevented from removing any part of the general surface of the copper. The real breadth and direction of the strokes, may be seen by rubbing them with a roll of cloth containing oil; for the oil will sink into the strokes and give them a blackish appearance. It should be remembered, however, that whatever diminishes the sharpness of the edges of the strokes, will diminish the sharpness of the impression they will yield, and therefore the oil-cloth should be used gently, and as seldom as convenient. When broad strokes are required, they should be made of several strokes very close together, and cut till they are a little below the general surface of the copper. By this means the bottom of the broad stroke will have a roughness which is necessary for it to retain the ink while cleaned by the printer, but it is no hinderance to the ink being taken up by the paper. If the broad strokes were produced at once, by the graver, their depth would be such as to overload the paper with ink.

Scratches and very slight imperfections of the strokes, may be rubbed out with the burnisher; those which are rather deeper, will require the scraper, and afterwards the burnisher; but to take out the deepest strokes, the copper must be hammered up on the back, and when the defective part is so much raised, that the false strokes will disappear by reducing it to the general level, it must be rubbed as in polishing a plate at first, and finished with a piece of soft charcoal.

When sculpture is represented, as it is always supposed to be white marble, or stone, the engraving should be light and smooth, the eye should have no pupil, and a certain degree of stiffness, or clotted appearance, must be given to the hair. Linen, should be represented by smaller, and closer lines, than other sorts of cloth, and by single strokes, except in some of the shades where it may occasionally be proper to have double strokes, to produce a good effect. Woollen cloth should have two strokes, and they ought to be fine or wide according to the supposed fineness or coarseness of its texture. In crossing the strokes, the second should be finer than the first.

Shining stuffs, such as silk or satin, require strokes which are harder and straighter that others; when their colours are bright, they are done with a single stroke; when dark, they require a double one; and the first strokes should be interlined by others, which are finer. Shining metals, glass, and smooth water, require clean single strokes, interlined by finer, except at the place of strongest reflection, where the strokes should be single. For smooth water, the strokes must be horizontal; in ruffled water, they must follow the course of the waves.

In representing mountains, the direction of the lines should be frequently interrupted, to shew the irregularities of the surface; but the greater the distance, the less of this should be perceived.

Dark clouds, greatly exercise the skill of the engraver, and generally require two strokes. Sometimes one set of the strokes are curved, and the other straight; sometimes both are curved; but in all cases, the intervals are more lozenge than for other objects. A serene sky, is represented by strokes parallel to the horizon, or by strokes following the same direction, but gently waved. According to the general rule for the sky, the strokes must be gradually stronger as they recede from the horizon.

In the lights of drapery, and other parts, where a few fine strokes are required, they should be put in with the dry-point, as that will be of the utmost importance.

The direct light of the sun falling upon copper, produces a glare which prevents the artist from properly seeing and executing his work. A screen is therefore employed, formed of tissue paper pasted upon a slight frame, which is placed in a sloping direction before the window at which the artist sits, and the light he receives passes through it.

Even of those engravings which are considered as wholly executed by the tool, the dark shadows, and such objects as trees, are usually done by etching, to which we now proceed.

(TO BE CONTINUED.)

ENGLISH PATENTS.

To Samuel Bagshaw, *of Newcastle-under-Line, in the County of Stafford, Gentleman, for his Invention of a new Method of Manufacturing Pipes for the Conveyance of Water and other Fluids. Sealed* 8*th August,* 1825.

His patent has two objects; first, to make pipes of clay, by a particular process; and, secondly, to unite those pipes, so as to form lengths of any indefinite extent.

In the first instance, cylindrical plugs of wood are provided, equal in diameter to the intended bore of the pipe, and of any suitable or convenient length; these plugs are to be coated on the outsides with soft clay, mixed up and laid on in the usual way of making pottery ware; a hollow cylindrical mould is then provided, consisting of two half cylinders, which when united and securely fastened together, form the mould for the outside of the intended pipe; the cylindrical wooden plug, with the clay surrounding it, is then passed through the hollow mould, and being squeezed hard, the superfluous matter becomes scraped off in its progress, and leaves the earthen pipe formed upon its plug. When this pipe has been dried, it may be readily drawn off the plug, and is then baked in the usual manner.

Two different sized pipes are thus to be made, the lesser pipes exactly fitted to pass freely through the inside of the larger. The lesser pipes being introduced into the larger, the space between them is to be filled with liquid cement of any kind, that is not subject to be affected by moisture, (Parker's cement is proposed,) and in thus uniting the pipes, care must be taken that the joints, or ends of the two inner pipes, are sufficiently covered by the outer pipes, for what is technically called, blocking the joints. Enrolled, October, 1825.

To William Weston Young, *of Newton Nottage, in the County of Glamorgan, Engineer, for his Invention of certain Improvements in the Manufacture of Salt, part of which improvements are applicable to other useful purposes.*

There are two objects proposed under this patent; the first, is to place iron rafters and plates between the furnace, and the under side of the boiler in which the salt is to be evaporated, in order to prevent the immediate action of the fire against the boiler; which, in the ordinary construction of salt pans, and their fire-places, is very apt to burn the salt, and thereby injure both its quality and colour; the second object, is to employ the steam evaporated from one salt pan, to the heating of another salt pan, placed above.

The plan proposed for the first object, is so extremely simple and evident, that drawings are not necessary to illustrate it. Iron bars, as rafters, are to be placed over the furnace, and upon these are to be laid iron plates, close beside each other, by which the immediate flame of the fire will be intercepted, and prevented from acting upon the boiler, though the heat absorbed by the iron will be sufficiently transmitted to the under side of the pan, to answer the purposes of evaporation.

The steam evolved from the pan, as the brine evaporates, is allowed to ascend in a confined chamber; and, to accomplish the second object of the invention, is to act against the under side of another salt pan, placed above. Enrolled, April, 1825.

It is rather extraordinary, that on the same day that this patent passed the Great Seal, a patent was also granted to William Furnival, of Anderton, in the county of Chester, for his invention of certain improvements in the manufacture of salt; and that the same object, viz.—causing the steam evolved from one salt pan, to rise in a confined chamber, for the purpose of heating another pan above, is contained in both specifications. In this case, neither of the patentees can be entitled to the exclusive use of the invention.

It is usual when two different parties are applying for patents having a similar object, that one or both of the parties takes out a caveat, to restrain the other from obtaining his patent, in which case the matter is referred to the Attorney or Solicitor-General, who receives both parties in his chambers, and hears them separately, and in private describe their plans. If their inventions are dissimilar, (of which he is to be the judge,) though having the same ulterior object, he allows both patents to proceed; but if they are considered to be alike, he refuses the petition of both, and stops the progress of the patent, unless they agree to become joint patentees of the same invention.

There is, however, no register preserved of the respective inventions; and, therefore, under these circumstances, it is impossible to compel a patentee to specify the same subject which he had described previously to receiving his patent. Hence there have been instances of persons explaining before the Attorney or Solicitor-General a subject as their invention, and after obtaining their patent, specifying something totally different, which they had invented or picked up in the interim. There does not appear to be any existing remedy for this evil; and we beg, respectfully, to propose the consideration of the subject in the proper quarter. [*Editor London Jour.*

To Samuel Brown, *of Saville Row, Burlington Street, in the County of Middlesex, Commander in the Royal Navy, for his New Invented Apparatus for giving Motion to Vessels employed in inland Navigation. Sealed* 15*th March*, 1825.

The patentee proposes to lay a chain or rope along the bottom of the canal or river, and having made it fast at both ends, to impel the boats or other vessels along, by means of a wheel with indentations round its periphery, or a toothed or spur wheel, taking hold of the links of the chain.

The vessel containing the steam engine, or other moving agent, is to proceed first, and the other loaded boats or barges, are to be attached behind, in a train. At the bow, or the stern of the first boat, the indented or toothed wheel is to be placed, and the chain raised up by means of a grapple, and passed over the periphery of the wheel. Things being thus disposed, the engine is to cause the indented or toothed wheel to turn by means of a rigger and band, or any other well known contrivance, when the teeth or indentations of the wheel, taking into the links, or acting against the shoulders of the chain, the vessel is progressively drawn forward.

The periphery of the wheel may be variously formed; with cavities or indentations suited to hold the links; but it is proposed that its flanges or outer edges, shall spread, or be made bell shaped, in order to permit the chain to drop off freely, after it has passed the actuating points. The chain is intended to rise up from the water, at the fore part of the wheel, and after passing over the upper part of its periphery, to drop down behind the wheel into the water again, without passing into, or even touching the vessel.

The chain may be in one length, from end to end of the canal or river, or it may be in many lengths, extending only from lock to lock, or to the different turns or angles of the canal or river; and one line of chain is intended to be sufficient for conducting the boats or barges both to and fro. When the boats meet in opposite directions, the towing boat on one side may throw off the chain from its wheel, and take it on again, by means of a grapple, when the other train of boats have passed. Enrolled, July, 1825.

To John Frederick Smith, *of Dunstan Hall, in the Parish of Chesterfield, in the County of Derby, Esq. for his Invention of certain Improvements in the Preparation or Manufacture of Sliver, or Slivers, or Tops from Wool, or Wool and Cotton, or other suitable Fibrous Materials. Sealed* 11*th January*, 1825.

The operations of a carding engine, are to separate, comb out, and lay straight, the filaments of wool, cotton, or other fibrous materials that may be passed through it, and the fine thin sheet of filaments produced by the operation, is technically called *sliver*.

The patentee having observed that warmth facilitates the operation of carding, (it having been practised for many years in combing wool,) proposes as a new invention, to heat the interior of the carding cylinder, by means of steam; and as wood is a bad conductor of heat, he proposes to make the carding cylinder of copper, which of course must be rendered steam-tight at the joints. Instead of setting the cards (wire brushes) in leather as usual, which would be soon destroyed by the heat, he proposes to fix the wires in block tin.

There are no particulars stated, as to the construction of the cylinder, except that the steam is to be introduced "through a hollow axis in the ordinary mode used by engineers for supplying steam in such situations with a waste pipe, to conduct away such parts of the steam as may be condensed." Enrolled July, 1825.

There have been, within the last two or three years, several patents granted for the employment of heat, in the preparation of wool, cotton, and silk; two of which patents have already been annulled by writs of *scire facias*, the principle having been long known, and in use. *Editor London Journal.*

To James Hanmer Baker, *of the Island of Antigua, but now residing in St. Martin's Lane, in the county of Middlesex, Gentleman, for his Invention of certain Improvements in the Arts of Dying, and Calico Printing, by the use and application of certain Vegetable material or materials. Sealed 29th March,* 1825.

These improvements consist in employing the husk and shell of the cocoa-nut, or the leaves, branches, and indeed every part of the cocoa-nut tree, as a material from which a valuable dying matter may be extracted. The husk that encloses the nut and the footstalks of the leaves, are, however, to be preferred, both as being the cheapest, and most convenient for use.

The husks and stalks are to be thoroughly dried in the sun, but previously, it would be as well to slice them into thin pieces. The trunks and roots may also be split and dried.

If it should be found more desirable, for the sake of transportation, the colouring matter may be extracted from the woody parts, by making an infusion in hot water, and then evaporating the water, until the extract is brought to a paste, or to a dry state; care being taken that no vessel or article of iron, be employed in the operation. Reducing the material however in this way, is not to be recommended; as the colouring matter, by this process, undergoes some changes which considerably diminish its utility.

The cocoa-nut husk, or branches, or leaves of the tree, having been dried, are to be reduced to small pieces or powder, by crushing between rollers, grinding, rasping, or otherwise, and the colouring matter may then be extracted by infusion in hot or cold water, which may be assisted by the addition of lime, potash, ammonia, or other alkaline matters.

A wooden vat is to be filled with the materials, (husks or leaf stalks are to be preferred) and after covering the vat with a frame, to keep the material from rising, the vat is to be filled with water, and allowed to remain in that state, for two or three days, according to the warmth of the weather, in which time the water will have acquired a yellowish brown tint. It is then to be drawn off by opening a cock at bottom, and a second and third charge of water poured upon it in the same way, until the colour of the extract is so pale, as to indicate that the material is spent. Another supply of the material is then necessary, and the same process is to be repeated.

With this extract, cotton, wool, hemp, flax, or silk, may be dyed a nankeen colour, by steeping in the liquor; the cotton, &c. having been previously cleansed and mordanted or not in the usual way, observing that none of the salts or preparations of iron are to be used. The mordant preferred for cotton goods, is a solution of pure alum, neutralized by chalk.

This infusion may be applied to printed goods, by having first covered those parts of a pattern intended to be white, with any of the mixtures commonly employed as a guard. The cloth being then steeped in the liquor, will receive the tint, and may be afterwards cleaned in the usual way.

The extract may be obtained by boiling the materials above mentioned, for an hour or more, in any suitable vessel, such as is commonly employed by dyers, (iron excepted.) While scalding hot, the liquor will dye goods by merely dipping them in, and drying immediately; but the durability of the colour is much increased, by previously passing the goods through an alum mordant. Another mode employed, is to dip the goods in, two or three times, drying them between, and then to raise the colour by a weak solution of muriate or nitro-muriate of tin, or nitrate of lead, or in oxymuriate of lime; after which, they must be immediately well rinsed in cold water, otherwise, the colour will be destroyed.

This dying material, contains, beside the colouring matter, a considerable quantity of the substances called tannin and gallic acid; the infusion therefore, whether prepared in the cold or hot way, will give with any of the salts of iron, a blue black colour, modified by the mordant. The salt of iron proposed to be employed, is the common iron liquor of dyers, made by dissolving iron in pyro-ligneous acid; and in this case, the extract from the cocoa-nut tree, made in hot water with lime, is to be preferred.

From the above extracts, by following the methods usually adopted by dyers, that is mixing astringent, yellow, and red colouring materials, olives, drabs, browns, grays, and a variety of other colours, of great beauty and durability, may be obtained; and in consequence of the quantity of tannin and gallic acid, contained in the cocoa-nut husk and leaf stalk, and indeed in every part of the tree, the infusion, whether a hot or cold extract, may be employed as a substitute for nut galls, or other astringent matter, in dying turkey red, and other colours.

The method of preparing infusions, or extracts and compounds for dyers, as above described, are not new; therefore form no part of the patentee's claims; but his invention consists solely in using the "husk and shell of the cocoa-nut, as well as of the whole and every part of the cocoa-nut tree, as dying or tinging materials, in whatsoever way the same may be applied, or may be applicable to these purposes." Enrolled September, 1825.

Specification of the Patent granted to Aaron Jennins *and* John Betteridge, *both of Birmingham, in the county of Warwick, manufacturers and japanners in ordinary to his Majesty; for certain improvements in the method or methods of preparing and working Pearl-shell into various forms and devices, for the purpose of applying it to ornamental uses in the manufacture of Japan ware, and of other wares and articles, to which the same can be applied.* Patent dated March 29, 1825.

We the said Aaron Jennins and John Betteridge, do hereby declare, that the nature of our said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows, (that is to say) our said improvements in the method or methods of preparing and working of pearl-shell into various forms and devices, are, first, by reducing the shell by filing, grinding, rubbing, or other proper methods, into flat plates of about the fortieth part, or in some cases, the one hundredth part of an inch in thickness. We then draw, or pencil upon them with a hair pencil, the forms, shapes, or devices we wish to give the pieces of Pearl, either in a solution of asphaltum, made in the essential oil or spirit of turpentine, resin dissolved in the same menstruum, wax, varnish, or any fit and proper material, which is calculated to prevent the action of acids upon those parts of the pearl-shell so defended. When the coating thus laid on, is dry, we then brush over it repeatedly, strong nitrous, or other proper acids, until, by corrosion, the forms so drawn or etched, are left free. We then clear off or remove the asphaltum, resin, or other defence, by means of spirit of turpentine or other proper solvent, and the ornaments, sprigs, devices, or other figures are then fit for use.

We can, if necessary, coat or cover the whole surface or surfaces of the pearl-shell, with an etching ground, or other proper defensive varnish, or material, which will withstand the corrosive action of acids. We then draw, or trace with etching-needles, the forms or outlines of the devices, through the said etching ground, or other defensive varnish. Having thus drawn or etched the forms of any ornaments, sprigs, devices or figures upon the pearl-shell, we then brush over it repeatedly, strong nitrous or other proper acids, as above described. We can also, if required, pencil or draw with the asphaltum, or other proper defensive varnish, the forms or outlines of any parts of the surfaces of the thicker ornaments so freed, which we wish to relieve or leave prominent above the other parts of their surfaces; and we then brush over them, the nitrous or other proper acids, until the intended effect is produced.

After having reduced the pearl-shell into plates, of about the eightieth, or the one hundredth part of an inch in thickness, in the manner above described, we draw the outlines of any figures or ornaments upon them, and place them upon any flat, and smooth, hard surface, as iron-tinned plate, slate, marble, &c. We then, with a penknife, or proper cutting tools made on purpose, or sharp-pointed instruments, cut them out of the pearl-shell for use.

Lastly, when we wish to produce a number of figures, ornaments, or devices, all of a uniform shape and size, we take from six to twelve of the plates of pearl-shell, of about the eightieth or the one hundredth part of an inch in thickness, and we unite or combine them closely together, by means of glue, gum, or other cement, into one mass; when dry and firm, we draw the outlines of the figures, ornaments, or devices upon one of the outer pieces, and holding the mass in a vice, or by other proper means, we, by the aid of files, drills, saws, or other proper tools or instruments, shape the mass into the required form; this done, by means of water, turpentine, alcohol, or other proper solvent, we dissolve the glue, gum, or cement, and the pieces become separated and fit for use.

By thus substituting *the free use of the artist's pencil* for the files, saws, and other tools, ordinarily employed in shaping this *brittle material* into form, *a degree of freedom and elegance is introduced into the pearl ornamental designs produced thereby*, of which we have never before seen any examples, the produce of this country; and we have no doubt that the employment of pearl in this way, will be very extensive in the arts. [*Editor Tech. Rep.*

Specification of the Patent granted to WILLIAM WHEATSTONE, *Music-seller, for a method of improving and augmenting the tones of Piano-Fortes, Organs, and Euphonons.—Dated July* 29, 1824.

I, the said William Wheatstone, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following specification thereof; (that is to say) my said invention, or method of improving and augmenting the tones of Piano-Fortes, Organs, and Euphonons, consists in covering as much of their external surfaces as possible, with frames formed either of wood, or other fit and proper materials, and having bars across them to strengthen or connect them together. These said frames are to be covered on both sides with thin, elastic, flexible, vibrating substances, tightly stretched over them; such as vellum, parchment, or other animal membranes, paper, canvas, woven-silk, linen, or any other fit and proper substances, or combinations thereof. These said frames are to be placed as nearly as possible to the strings of the Piano-Fortes and Euphonons, or to the pipes of Organs, in order that the interior flexible substances they are covered with, may receive the vibrations from the strings or pipes when sounded, aided by the sound-boards; and, by reverberating them between the two flexible surfaces, and through the agency of the columns of air therein interposed, greatly improve the quality of the tones produced from the instruments, and communicate them, thus improved, through the exterior flexible vibrating surfaces, to the auditor. Thicker or thinner flexible vibrating substances may be employed to cover the frames with, according to the nature or quality of the tones ordinarily produced by the instruments; for instance, in those instruments which have lesser powers of producing tones than others, or where more power is required from the instruments, I would employ thinner vibrating substances, than in those cases where the tones of the instruments are too loud and harsh, and require thicker vibrating substances to ameliorate them. I also, occasionally, cause holes to be made, either directly through the outsides of the frames, to their interiors, or else communicating with other holes, at right-angles to them, reaching from the interior of the frames; and which said holes convey the tones from between the flexible vibrating surfaces to the external air, with additional effect. I also furnish the exterior of these holes with trumpet-mouthed tubes, about an inch in length, or longer; or else cover them with hollow trunks or tubes, communicating with several of the holes; and which said tubes have convenient orifices, at their ends, sides, or fronts, opening to the external air. In some instances it may be also desirable, for the purposes before mentioned, to form other holes, in the insides of the frames, communicating with their interiors: similar to those above mentioned, as proceeding from their outsides.

MECHANICAL JURISPRUDENCE.—No. 7.

BY PETER A. BROWNE, ESQ.

On the Law of Patents, for New and Useful Inventions.

When an application is made at the office of the Secretary of State, for a patent, no judicial investigation takes place into the qualifications of the patentee. Any one who will make the necessary oath, will comply with the *formal* requisites of the act of Congress, and will pay the very small sum of $30, into the Public Treasury, can obtain letters patent, signed by the President, and sealed with the seal of the United States; and the validity of his claim to an exclusive privilege, if disputed, depends upon circumstances, which may be enquired into, in a subsequent judicial examination. To any one who is made acquainted with the facility with which letters are thus obtained, it will not be a matter of surprise, that unworthy persons take advantage of a law, made to protect the deserving. Instances are on record, of some patents taken out for things not embraced by the act; and others, by persons who had no shadow of title to the invention. To detect and punish these imposters, the public must possess at least, a general knowledge of the law of patent rights, and this knowledge it is proposed to diffuse by means of these essays. But if it is important to the public in general, to acquire a knowledge of the patent law, much more so is it to the *ingenious mechanic*. Experience has shown, that it is to this valuable class of the community, that the world is indebted for many of the most useful improvements in the arts; and it is distressing to reflect, that when one of them shall have laboured for years, in projecting a new invention, and expended his hard earnings in making the necessary experiments, that all his hopes shall be blasted, for want of as much knowledge of the laws of his country, as can be acquired in a few hours reading. Perhaps it may be said that he can obtain all this information at a small expense, from the professional gentleman, to whom he will apply to draw up his specification; but let it be remembered, that in many instances, this knowledge may *then* come too late; he will not apply to counsel until he is ready to take out his patent, and the chances are, that long before that period shall have arrived, by some inadvertent act, he may have made his discovery public, or in some other way have forfeited his right to a patent; after which, he can never claim the exclusive privilege of using his own invention.

That the subject is *fertile*, will at once be perceived: a proper discussion of it, will necessarily involve the following topics, viz:

An inquiry into the requisites in order to obtain a valid patent.
The proceedings to obtain a patent.

The benefits, privileges, and remedies of a patentee.

The methods of *contesting* a patent claim.

The whole will be occasionally interspersed with such advice to patentees, as reading or experience has suggested.

With respect to the intricacy of the subject, it is necessary to observe that in discussing the patent law of the United States, I shall be led to take considerable notice of the laws of England on the same subject. This course will be found to be indispensable; the laws of the two countries are so interwoven together, that a perfect understanding of the former, is much aided by a general knowledge of the latter; and when we consider how many ingenious American citizens, have taken out, and are daily taking out, patents in England, no one will, I trust, consider the time lost, which is employed in examining the patent law of that country.

The laws of England, with respect to patent rights, are to be studied in the common law, the statute of 21st James the first, and numerous adjudged cases. These cases are to be sought for, in hundreds of volumes of English reports, now extant; and when found, they are, some of them, contradictory, many, obscure and difficult to be understood, and the whole, devoid of all methodical arrangement. The student has not in *this* branch of the law, as in some others, the advantage of consulting any well written elementary treatise. Almost the whole of Mr. Davis's book on patents, is occupied with cases, extracted and copied verbatim from the English books of reports, and inserted without regard to any thing, but chronological order; and the remaining part, (except the introduction) containing what he calls his *practical observations*, is ill digested, and devoid of arrangement.

From this chaos, to call forth a system, is a task requiring labour and perseverance.

Upon the British stock, has been engrafted the American scion, which will be found in the Constitution of the United States, the acts of congress, and the numerous and highly interesting decisions that have taken place since 1793, in the several District Courts, in the Circuit Courts, and in the Supreme Court of the United States.

Judge Washington, in the case of Pettibone *v.* Derringer, M. S. rep. C. C. U. S. Penna. District, pronounced controversies concerning patent rights, to be the most difficult that are presented to courts and juries; and Judge Story, in the case of Barrett *v.* Hall, 1 Mason's rep. 472, declared that the doctrine of patents, in truth, constitutes the *metaphysics* of the law. It surely becomes me to approach with diffidence, and to discuss with caution, a subject, considered so profound and so intricate, by those two great American legal luminaries.

When we contemplate the wonderful improvements that have taken place, within the last half century, in manufactures and the useful arts, and when we consider the happy effects that these improvements have had upon the condition of the human race, we are inclined to think that a brief history of the rise and progress of the law of patent rights, upon which these improvements are founded, and with the aid of which they have flourished, will not only prove amusing, but highly interesting and instructive; and particularly so, to the citizens of this republic.

Upon taking a comparative view of the new and useful inventions and discoveries that have been made *prior*, and *subsequent*, to the passage of the patent act, we are led to the opinion, that that statute has been a powerful incentive to genius and industry; and this idea has been strongly corroborated by the additional consideration, that in the same proportion as the patent law has been understood, and the rights of the patentees been secured and established, has been the *increase* in the usefulness as well as in the number of these discoveries. The principal part of the British decisions upon patents, have taken place within the last half century; and do we not all know that *that* period has been eminently distinguished, by the most brilliant inventions?

Mankind have always considered themselves under an obligation to those, by the force of whose genius, or intense application, some new and useful discovery has been made; but the degree of respect which has been shown them, and the nature of their remuneration, have been different, in different countries, and at different times.

Some of the ancients, paid them divine honours. Athens was particularly famous for her knowledge of the arts, and her manufactures of all sorts, were in high repute; the reason was, that emulation was excited by the *public rewards*, and *honours*, which were bestowed upon those who attained to excellence, in any of the useful arts.

Of all the methods devised to compensate the inventors of new and useful improvements, that, by granting them an exclusive right to use their own inventions, for a limited time, is the most *just* and *equitable.*

It is a payment *in kind;* graduated by the degree of usefulness of the invention. If the discovery is but of *small* advantage to the community, let no one envy the inventor the exclusive use of it, for fourteen years; for his compensation will be *proportionably small;* and if the exclusive use of the invention for that period, is likely, in another case, to be *immensely profitable*, let it be recollected, that it can be so only upon the principle, that the discovery will afterwards, be of *immense advantage to the public.*

An Essay on the Bombyx Mori, or Silk Worm, read before the Maclurean Lyceum of Science of Philadelphia, June 11th, 1826, *by* JOHN T. SHARPLESS, M. D.

As this small, but interesting animal, has began to attract the attention of all ranks of society in our country, from the ruler to the peasant, and as a particular and useful knowledge, is confined to few, I have been induced to collect what is known upon the subject, to deliver before you, not for the purpose of satisfying, but exciting curiosity; in hopes a desire for further knowledge, may induce you to study this useful being, for yourselves.

The Silk Worm is generally supposed to be a native of China, though it has been asserted, that it was introduced there by the Jews, from India, about the conquest of Alexander. There is, however, in the annals of that country, mention made of articles of silk, 780 years B. C. but it is unknown, if of this particular animal, or of another similar. The use of this article, was introduced into Greece and Rome, through Persia. It was, however, so extremely expensive, that it sold for its weight of gold, and the Emperor Aurelian, is said to have refused his wife a dress, from its dearness. This great price was caused by the immense distance to be travelled from China to Syria, caravans being 243 days on the road. Virgil and Horace are the first Roman writers who mention it, and they supposed it to be a kind of down found on leaves. It was also thought to be a sort of wool or cotton, or the production of a species of worm, which they called ser, and the silk sericum. The Emperor Justinian, anxious to introduce the worm itself among his subjects, made many fruitless attempts, by negociation, but accident produced what power could not. Two Christian Missionaries, in their wanderings over Asia, about the year 555, stole into China, concealed some of the eggs in the hollow of a cane, and brought them to Constantinople. The animal was soon distributed over the Mediterranean, Sicily and Italy, in particular, and about the year 1600, was introduced into England. They had, however, been familiar with silk a long time before, but it was so expensive, that James first, of Scotland, had to borrow a pair of silk stockings of the Earl of Mar, to appear before the English Ambassador, using this irresistible persuasion. "Ye would not sure, that your king appear as a scrub before strangers."

About the year 1770, it began to attract attention, in the then British colonies, and under the particular patronage of Dr. Franklin. By his exertions, a society was established and incorporated, by the name of The Filature of Philadelphia. Large quantities of silk were raised, and sent to England, for manufacture. Premiums were offered of £15 for the greatest number, not less than thirty thousand, and £10 for not less than twenty thousand cocoons. They also gave 25 per cent. more than they could be sold for, in other parts of the provinces.

There are still many articles in use in Chester County, the silk of which, was raised under the British Government. The revolutionary war, however, interrupted its cultivation, but within the last four years, a disposition to resume it, has prevailed to a very considerable extent, and it is hoped, may continue, till silk will become one of the staples of our country. This revival has been produced, in a great measure, by the praise worthy exertions of Mr. Samuel Alexander, of this city. A number of eggs were brought by him, a few years since from Gibraltar, from a very laudable curiosity to observe the peculiar habits of the animal. He was soon struck with the probable advantage the country might derive from its propagation, and by indefatigable perseverance and industry, he has produced and distributed about five millions of eggs; most of the worms in and near the city, are the production of his Gibraltar eggs. He has, however, lately received some of the best Italian eggs, which will probably improve the breed. It was also through this gentleman, that Mr. Miner was induced to bring forward his motion in Congress, to investigate the matter. Such exertions for his country's good, deserve the applause of the world, and the gratitude of his fellow citizens.

Dr. Mease also imported a quantity of eggs from Genoa, which were deposited, and the worms are now thriving at the Hospital.

There are at this time, about five hundred thousand animals in Philadelphia and its vicinity. The largest collections I am acquainted with, are those of the Hospital, twenty-five thousand, Mr. Alexander, Mr. Dusar and Mrs. Kempton, each ten thousand. There are also some others, I have not visited. Mr. Dusar, who became interested in the subject through Mr. Alexander, has sent to Europe, for books, eggs and the finest kind of mulberry trees. He has already, a large quantity of trees, and purposes prosecuting the subject, till a regular establishment is founded. Those who wish more practical information, should call on either of those gentlemen, who are very obliging in distributing eggs, and communicating knowledge.

The silk worm belongs to the great division of entomology, Lepedoptera, Genus Phalina, and Sub Genus Bombyx, Species Mori, from its food. As it is not intended to give a technical description of the genus and species, I shall pass on to that kind of matter, that is more immediately useful. It belongs, however, to the same genus as our moths and butterflies, but differing from some of them in remaining in the egg during the winter, whilst others spend the cold season in the cocoon. It also differs from the butterflies in not flying in its wild state in the day, always waiting for the evening. In

China this animal is found wild, and producing, without any trouble, large quantities of silk, but cultivation has a happy effect, even in its native country, the finest silk by far, being the production of the sheltered worm. Of all the European countries, Spain produces the finest insect, hence, even the French and Italians are compelled to renew their breeds from that country, every few years. Through all parts of the world, this little being follows the same course in its changes, and in nearly the same time. It can, however, be forced to go through its metamorphoses more rapidly, by very frequent feeding. Instead of 40 or 45 days required from birth to the cocoon, they are in China, forced to complete their changes in 25. They have also, in in this state, commenced spinning in 26 days.

The changes this useful creature undergoes are really astonishing. Spending its winter in the ovum or egg, a nearly shapeless mass, on the approach of warm weather it bursts from its thraldom, and appears an animal much like a small black ant. His increase of size is very rapid. In eight days, he has increased from the sixteenth, to one-fourth of an inch in length. He now becomes still, ceases to eat, raises his head some distance from the surface, folds his feet together, and looks much as if in the act of supplication. He begins to wriggle his body, and labour apparently in pain, but his skin soon becomes broken in the back, and he slips out of it, of a yellow colour. The covering to his head separates in a distinct piece. This process is generally accomplished in 36 hours. In a short time he begins to eat again, and grows more rapidly than before, attaining in five days more the length of half an inch, and then again goes through the same process of skinning himself. In another five days, he is more than one inch in length, and again undergoes the process of cutaneous deprivation. In another five days he makes his fourth change of garment, and soon after, arrives at his full size of three inches. He now eats voraciously, till within a few hours of his spinning, when he becomes translucent, wanders about examining the premises, and leaving silky traces on his path. He commences this process by fixing on some corner or spot where he can form a hollow space for his habitation. He attaches his thread from side to side, though several inches may intervene, not following the radiated style of the spider, but seeking to strengthen his scaffolding by every means in his power. These long threads are crossed in every direction, rapidly approaching the centre of the enclosed cavity, till it surrounds a space about the size and shape of a pigeon's egg, when they become more compact, the filaments being placed in close contact, and shutting out the air, and light. The motion of his mouth, is now that of the figure 8. In 24 hours he can no longer be seen, though his labours may yet be detected by the ear. As the spinning process goes on, the contents of his body diminishing, he rapidly contracts in size, and in five or six days, he has completed his cocoon. He now appears about an inch in length, his skin dry and shrivelled. In about twenty-four hours after he has terminated building, his skin becomes loose, opens in the back, and slips off him, leaving him without feet, the shape of his system changed, and with the rudiments of wings and antennæ. In 15 days from the commencement of spinning, the skin, covering the head of this aurelia, or chrysalis, opens, and it emits a liquor which softens, and weakens the threads, at the end of the cocoon. I have not been able to ascertain, positively, whether he really gnaws the filaments, or merely breaks them after their texture is destroyed ; according to Mr. Swayne, he only separates them from each other ; but a hole soon appears, through which a full grown, white moth issues, leaving a hard, brown case behind. Both males and females, now discharge a reddish fluid from their tails, and the sexual intercourse commences ; this continues twenty-four hours, when the female begins the last process of her existence; depositing her eggs upon any substance that falls in her way, generally laying from two to five hundred, and having performed this office, dies a short time afterwards. If no intercourse should take place between the sexes, a number of eggs may still be produced, but they are barren. Upon opening a very strong cocoon a few days since, I found a fly actually ovipositing, within the case that it leaves in the ball. The animal was much diseased, and unable to make its way out, and had commenced the deposition of these unimpregnated eggs within the cocoon. The eggs remain dormant till the following spring, when they follow the same round of change as their ancestors.

The external appearance of this curious creature is now so well known, that I shall pass on to a general description of its internal anatomy, as described by Malpighi and Blumenbach. In the larva or worm, there is a straight hollow tube, extending from the mouth to the anus, which is its stomach, and intestines; also a double vessel, much convoluted, about one foot in length, containing the gum, which afterwards becomes the silk. This gum-vessel extends very low down in the body, and terminates, by an orifice, at its anterior extremity, in a papilla on the lower lip. The gum contained in this vessel assumes, towards the spinning time, the particular colour the silk will have, is extremely tenacious, and dries into a hard insoluble mass; and if a thread be drawn out much thicker than silk, when dry, it will break like glass. The *respiratory* apparatus consists of nine dark points on each side, called *Stigmati.* From these extend tubes, terminating in a large air vessel on each side, called *Trachæ*, running the length of the body, and from which innumerable ramifications pass all over it, coming in contact with the extremities of whatever vessels carry on nutrition. What these nutrition vessels are, have not been ascertained. Baron Cuvier considers them mere imbibing tubes, that deposit what they absorb from the stomach. The *circulating* arrangement is equally little understood, the contracting and dilating vessel on the back, being supposed by Malpighi, to be a succession of hearts, receiving fluids absorbed from the stomach, and distributing them round the system, but never returning; whilst Lyonet could find neither entering nor salient vessels, and supposed, therefore, it carried on some secreting power now unknown. The whole worm, however, seems a mere mass of vessels, containing a green or yellow fluid, answering the purpose of blood, but how produced or propelled, is, I believe, also unknown.

In the Imago or Fly, the circulating and respiratory apparatus remain nearly as in the worm, whilst the digestive machinery has almost disappeared, now answering no apparent purpose. In some of the Lepidoptera, the Papillio or Butterfly, for instance, the stomach is kept in slight operation by the honey of flowers that it sips, but I cannot discover that the moth tribe eat at all—the whole space once occupied by stomach and intestines, being now filled by the ova, or other requisites for continuing the species.

The time the egg should be hatched, depends on the vegetation of the mulberry. It is usual and correct to keep the eggs in a cool, dry place, till the leaves are the size of a dime. It is also recommended to keep half the eggs, until it is impossible that a frost can blight the leaf, and the worms starve; but if the leaves have arrived at that size, there is little danger of an accident of this kind. The eggs may even be kept in an ice-house, if the warm weather threaten to bring them forward too rapidly; neither is there any danger from an exposure of them to cold, for Spallanzani placed them in a temperature of 38° below zero, without injury. It has been recommended by some writers, to steep the eggs in weak wine and water, one fourth of an hour, just before you expect them to hatch, and the "breed will be much improved, producing a stronger worm." When the season arrives for the hatching, which is generally the beginning of May, they should be brought into a warm place, as in the sun, and in a few days they will burst the egg. In Europe, persons sometimes carry the egg about, near the skin, to bring them forward, but the heat of the sun, or of a warm room, answers the purpose. In China, a fire of the dried dung of Cows, is considered the best. L'Abbé Boissier recommends a fire of well dried tanner's bark, turf, or sea-coal, as burning slowly, and giving a regular heat. You may know when they are near hatching by their changing colour, from a dark purple, to a pale blue. When large numbers are raised, the eggs, at the time of hatching, are spread out on a board in layers of not more than half an inch thick, and a wicker or net frame, or, a sheet of white paper, pricked full of large pin holes, placed above them, but in contact, with leaves upon it. The worms, as they are hatched, crawl through the openings, and must be removed as their numbers increase; this is necessary, as the worms, on immerging, spin a fine silk over every thing that they touch, which often fastens many together. They should be kept on sheets of paper till they have passed their second moulting, and then be removed to an apparatus, which saves a vast deal of labour; this has four upright posts, to form a frame of not more than five or six feet in length, and about thirty inches deep; cleets are placed, about twelve inches apart, on which moveable frames, with wire middles, slide; a drawer is placed about two inches under each shelf, to receive what falls through the wires; this must be removed and cleaned every day. The apertures between the wires must be proportioned to the size of the worm. The distance between the drawer, and shelf, must not be so great that the worm cannot get up again, if he should happen to fall through. This apparatus is now used by Messrs. Alexander and Dusar. The insect now requires fresh air, which must be freely admitted; care must also be taken to keep out other animals; Mr. Dusar places, for this purpose, wire netting before his windows. An old work, printed in 1653, on the cultivation of the Bombyx in Virginia, recommends that occasionally you should burn in the room some "Juniper and other herbs that give good smells," and also have scented flowers always in the room. If, on the appearance of the worm, any cause prevent you from obtaining the white mulberry, you must employ lettuce or salad; I shall speak, however, more particularly of their food, in a succeeding part of this essay. It is absolutely necessary that their food, whatever it may be, should be perfectly free from dampness, as this will destroy the animal. I have been unable to ascertain if the sheltered China worm is equally affected by moisture; the wild animal is certainly accustomed to it. In China, the worms are fed forty-eight times, the first twenfour hours; the second, thirty, and each day the number is decreased; but even at the close they are fed six times, regularly, every day. This greatly diminishes the time occupied by the animal in its different metamorphoses. They ought certainly to receive fresh young leaves every four hours, for the first two or three days, and the frequency may be then diminished, and towards the spinning, twice a day is often enough. It is more economical, whilst the worms are young, to cut the leaves up into pieces, the size of a cent. Until they are placed upon the frames, they should be separated from the dry leaves and excrement, every day, having a very natural dislike to living among their own ordure. This can be conveniently done by sweeping the old leaves on which the worms are sticking, into a row, and placing parallel to this, and within half an inch, a second row of fresh leaves. They soon smell the new food, and leave the old, which may, in fifteen minutes, be removed. In China. before feeding them, they dry off what moisture may have collected, by passing a whisk of burning straw over them, or place them a few minutes in the sun. The animal at this time, as also whilst in the egg, must be preserved from other insects, or vermin. The Larva, or worm, is subject to disease that must be attended to. By bad diet or exposure, they become indolent, cease eating, the skin becomes relaxed, and the colour changed: there is now, according to L'Abbé Sauvage, but one remedy, and that is the cold-bath: they should be thrown by handfulls into cold water, for a minute or two, and then replaced on their shelf. If they seem languid and contracted afterward, a little heat will soon revive them. In Georgia they burn brown sugar as a remedy.

When the time arrives for spinning, the excrement that was perfectly black, and shaped like a mulberry, now assumes a loose texture, of a greenish hue, and resembles very finely powdered leaves. It appears as though nature had perfected the animal, and the powers of digestion must cease, and the food pass through unaffected. This, however, is not altogether the case, for it is partly soluble in water, and produces a dye of a green colour. Mr. S. Alexander ground it with oil, and made a pigment. After the discharge of this substance, a glairy, transparent fluid follows as a closing operation, and every process, except spinning, apparently ceases.

To facilitate this undertaking, has been a subject of enquiry for a long time, and many experiments have been made to compel them to *ramer*, as the French call it, or climb. If the weather is very warm, they will not ascend, but seem exhausted, spinning their silk on every substance they touch. To induce them to mount, the Italians carry into the room a smoaking hot cake, made of onions and eggs, when they seem revived, instantly. In Georgia they rub the shelves with fennel for this purpose. The smoke of tobacco is extremely disagreeable, and will prevent their spinning.

They have also some choice in the articles to which to attach their ball; in Georgia, rows of oak bushes that have been drying for several days, with their leaves, are stuck upright in rows near the worm. Mr. Alexander also, believes them to be next in goodness to the bamboo, which is used entirely in India, and is, undoubtedly, the best article. The bamboo, is used with is branches attached, or is split, and plaited into little cells or boxes. They will also spin in small paper cones, or in wine glasses, but on a large scale this is too troublesome.

We shall find, however, notwithstanding all our trouble, some worms which will not mount or spin a regular cocoon, but wander about as if attending to every body's business but their own. They will be constantly spinning, but it will be on their neighbours' territories, fastening the houses of others together, and doing mischief by that means; or they will work indefatigably on a flat surface, forming a pretty exhibition of the spinning process, but not for their own benefit, as they can make no cocoon. These larvæ, however, follow the same course as the others in their metamorphoses, and form a fly in a regular manner.

As the little being has no sex before encasing itself, it requires some experience to detect the two sexes whilst in the cocoon, for the purpose of laying by, for seed. An equal number of each, should be selected. Pullein says the male cocoon may be known by being more pointed, and smaller, the female being regularly oblong and larger. In the Genoa worm this description entirely fails, as no possible difference can be detected. In this selection you should choose the earliest spun, largest, firmest, deepest coloured balls. It is recommended to run a thread through the loose silk of the chosen balls, and to hang them up in the free air.

When the Moth makes its appearance, its wings are compressed, but they soon expand and perform their proper office. The male is now known by his greater activity, being always in motion, and by his darker coloured wings, and smaller body. The female has a large pendulous belly. The flies may now be placed in contact, on a rough cloth.

The eggs, when first emitted, are of a yellow colour, but in three or four days become of a bluish ash colour, and flattened, or slightly indented. The eggs that do not change colour, are unimpregnated, and, therefore barren, and should be thrown away.

The number of insects to keep for breed is easily calculated. Two hundred flies of each sex producing an ounce of eggs, which is about forty-five thousand. In China, the eggs are deposited on sheets of paper, which are hung up in the air to dry, far removed from any hempen rope, as this, they say, destroys both the eggs and worms of some size. About the last of December they are put into cold water, in which has been dissolved a little salt, or weak mulberry-tree lye, or are hung up in the rain. They are then loosely rolled up and placed in a dry situation. All the care necessary in our own climate, is to expose them to the air a short time, then wrap them up loosely and put them in a dry place. In Italy, they dip the cloths on which they are deposited, into wine and water, which softens the agglutinating substance, when they are carefully scraped off and placed in a box.

As there is generally a crop of eggs by the last of June, it has been a subject of inquiry, if two profitable crops of cocoons could not be raised in a season. In Romagna, and La Marche de Ancona, they regularly have two Racoltas or Harvests. They keep the eggs cool till the leaves shoot out afresh, which generally takes place in September; and if the worms appear before that time, they are fed on rose leaves, lettuce, etc. The mulberry can also be forced in a degree, by putting branches in warm water. The cocoons of this second crop, are much inferior to the first: this has failed entirely, both in France and in this country. In extremely warm parts of the world, Bengal and the Isle of France for instance, this second, or even a third hatching cannot be prevented; for according to Dr. Anderson, "the time necessary to go through all the evolutions, is forty-five days from the egg to the death." That is to say, they are six days an egg, twenty-two a worm, eleven in the cocoon, and one a moth. In our own country, they are generally forty-two days in the larvæ state, sixteen in the cocoon, and two, as an imago or fly; making sixty days as a perfect life time. This however is not universal, for in the hospital of this city, the average life of the larvæ was but twenty-six days.

(TO BE CONTINUED.)

FOR THE FRANKLIN JOURNAL.

On an Economical Mill, for Grinding Grain, to be worked by horse or ox power.

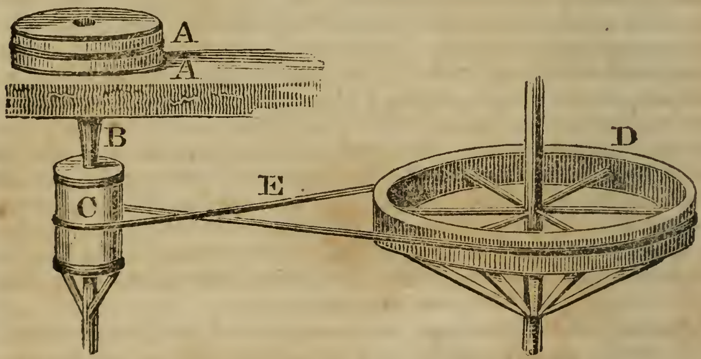
TO THE FARMERS AND PLANTERS OF THE UNITED STATES.

A large portion of the farmers, and others, living in all parts of the United States, have, from the earliest period of its settlement, to the present day, suffered much inconvenience, and had their comfort and prosperity greatly abridged, in consequence of the great distance of their dwellings from grist-mills; and the frequent summer droughts of late years, have caused the evil to be more extensively felt.

Good mills are now very general, yet thousands of us are settled at such a distance from them, or see those in our neighbourhood useless from want of water, during a large portion of the year; that the labour of carrying grain to the mill, is frequently greater than would be necessary to grind it, were a mill constructed, that could be worked with facility by a horse, or an ox. In such a mill, the very animal which is now employed to carry the grain, and wait for, and return with the flour, might sometimes grind ten times the quantity in the time which is necessarily lost.

Various plans for making cheap and simple mills, have been proposed, but from their not getting into general use, it is to be presumed that they have not been found to answer the purpose. The writer feels confident that the objections which have existed to those which have been heretofore erected, will be completely obviated by the plan which he is about to propose. He is aware that economy is a point of the first importance; the mill which is here described, will cost much less than those which have been heretofore erected for a similar purpose; its construction is very simple, and the common country carpenter and smith, will find no difficulty in completing it.

The plan it is believed is new, and that it is effectual, has been fully ascertained, as the writer has a mill of the description, now at work. The subjoined sketch, will give a sufficient idea of those parts which it is necessary to describe.



AA, are the mill-stones.

B, the spindle which supports the upper stone.

C, a drum, upon the spindle, made long, to prevent the belt from running off.

D, a large gin, with its shaft and arms; the lever to which the horse is to be yoked, is not represented.

E, the belt of tanned leather, five or six inches broad, with a buckle, to give it the necessary tightness.

It has not been thought requisite to represent the hopper, and other necessary appendages, as with these every country mechanic is sufficiently acquainted.

The larger the circle in which an animal draws, the greater will be his power. Less than eighteen feet will not answer, but twenty-four feet will probably be found in most instances to be more suitable. If a horse make three turns in a minute, in a circle of this size, he will travel at the rate of about two and a half miles in an hour. Then if the diameter of the gin, or large drum, be to that upon the spindle, as forty to one, the stone will make one hundred and twenty revolutions in a minute. In this case, the gin may be thirty feet, and the small drum, nine inches in diameter; but it will probably be better to allow one foot for the drum, which will give to the stone, ninety revolutions, the track of the horse remaining as before; it is evident, however, that if this track is made smaller, the horse, travelling at the same rate, will give greater velocity to the stone.

There are several advantages in making the belt wide, as it takes a firmer hold, is less subject to stretch, and less apt to slip off.

In different diameters of the stones, and other changes, the whole must of course be so modified as to suit them, but this can be done by any man of common understanding. It will always be best to place the whole under cover, not only to preserve the wood work, but to enable the farmer to work in wet weather; the belt, if wet, would stretch, and not turn the stones. It will probably be found best, in most cases, to place the stones, hopper, &c. in the corner of a barn, or other suitable building, with the gin on the outside, and the strap passing through holes made for the purpose. S.

ON JAPANNING AND VARNISHING, No. I.

BY THE EDITOR.

The art of making, and of using, the different species of varnish, is one of high importance, not only on account of the exquisite beauty of an infinite number of articles upon which the japanner has exercised his skill, but also as it contributes to the durability of a variety of materials used in domestic economy, and in the arts, and enables us to employ others, which without its aid, would be altogether unfit for the uses to which they are now appropriated.

The recipes and processes generally given in works written upon this subject, are extremely defective. The common practice has been, to copy from book to book, the false or imperfect accounts which were at first published by persons who were without practical knowledge, and who had in many instances obtained them from those who were interested in keeping some material part, secret. In general, when the recipes are good, the directions are so brief, as to be altogether useless to those who are not already practised in the art; or at least, so incomplete, as to occasion many failures in the attempt to put them into practice. In the midst of the mass of rubbish which has been accumulated in the "*Thousand valuable Secrets*," "*Guides*," "*Instructers*," and a variety of other books, which have at various times issued from the press, there is a portion of valuable matter, which ought to be collected, and methodized. In many of the philosophical, and other journals, both foreign and domestic, much is contained, which from its isolated situation is of little general utility, being rarely accessible to the practical man. From these sources, it is intended to obtain whatever is worth preservation, and to present it in a form as clear, distinct, and practical, as possible. Precise directions will be given for preparing, using, and polishing, the different kinds of varnish. In accomplishing this, the editor is aware that he must sometimes enter into a minuteness of detail, which to the initiated may appear tiresome; but it must be recollected, that he does not expect to instruct persons of this class; as respects them his most ardent wish is to obtain their aid in the accomplishment of his purpose. In order to teach well, we must suppose the learner entirely ignorant of the subject in hand; and request those who are not so situated, to recollect the period when a similar course would have been welcome to themselves.

The editor has been in the habit of making, and of using a variety of varnishes, and can therefore draw upon his own resources to a considerable extent, but he is not dependant upon these alone, for original information. Mr. John Meer, a gentleman well known in this city, who has been, for more than half a century, in the habit of manufacturing and using almost every kind employed, both for coarse and fine purposes, has promised his aid in the prosecution of this undertaking. Whatever these numbers may contain, may be considered, therefore, as perfectly correct, being the result of actual experience.

The materials used in varnishes are numerous, but they all consist of some solid substance, dissolved by the aid of a liquid. Sometimes, though rarely, the two are found in nature, combined together, so as to furnish a native varnish; that most celebrated among the Chinese, and Japanese, is said to be of this description. The solids which enter into the composition of varnishes, are those generally known under the name of gums, and resins. There is, however, considerable confusion in the names given to these substances, several of them properly belonging to the class of resins, being denominated gums; thus we have gum copal, gum animi, and a variety of others, which are improperly so called. Their distinctive characters we shall presently examine.

The *menstruums*, or fluids, used to dissolve the solids, are not numerous. Water, alcohol, ether, some of the fixed, and of the volatile oils, constitute the list. The purity of these articles, is, in many instances, a point of considerable importance, and we shall, in the course of our investigations, pay particular attention to this part of our subject.

The term Japan is used to designate those varnishes, which give to articles an appearance similar to those which are imported from Japan, and other parts of India. The name of Japan varnish, is frequently appropriated, exclusively, to that species of oil varnish, which is used upon waiters, and many other articles, and which is dried by the heat of a stove, constructed for the purpose.

Gums are the inspissated juices of certain vegetables, before the gum is dried, or after being dried, if it be dissolved in water, the solution is called *mucilage*. The gums, properly so called, are soluble in water, whilst the resins are entirely insoluble in that fluid; gums are insoluble in alcohol, remaining unchanged in it for any length of time; and indeed they may be precipitated after having been dissolved in water, by pouring alcohol into the solution. The species of gum most extensively used, is gum arabic, or senegal; that which exudes from plum, peach, and other trees, possesses similar properties. Gum water may be considered as the most simple of the varnishes; it is sometimes used on pictures, and on painted toys, to give them a gloss, but as it is readily dissolved by water, it is of little value; sometimes it is employed before using spirit and oil varnishes, to prevent their sinking into the substance varnished; of this we shall speak more fully, when treating of varnishing upon paper. Some writers consider insolubility in water, as an essential characteristic of varnishes, and do not therefore view solutions of gum, as belonging to the number.

Gum tragacanth, also called gum dragon, is sometimes used, as will hereafter appear. This gum does not dissolve like the former, but when covered with water, it swells and becomes a soft pulp, which will mix with other mucilages, and dries hard and glossy, but will not resist water. Most plants contain a considerable portion of gum, and many a very large quantity.

The resins, like the gums, exude from certain trees, either spontaneously, or from incisions made for the purpose. They resemble the gums in external appearance, but differ from them essentially, in many of their properties. The resins are softened and melted by heat, they burn freely, and with a vivid flame, and generally with a fragrant smell. They are insoluble in water, but most of them dissolve readily in alcohol, and, probably, they are all soluble in this fluid, under proper precautions. The resins are precipitated from their solutions in alcohol, by water, a small portion of which, dropped into any spirit varnish, will immediately render it turbid, or milky. This fact should be remembered, as it will be found of importance in the process of varnishing. The resins are generally soluble in ether, and in essential oils; many varnishes are made by dissolving resins, in oil of turpentine; and other essential oils are occasionally employed to promote the solution of some of the most refractory of these substances. The fixed oils dissolve many of the resins. Linseed oil, is the one most commonly used for this purpose, forming what is called an oil varnish. Common rosin, is the most familiar example of the resins. Copal, Mastich, Sanderac, and several others, are also in common use.

There are some substances found in the earth, which strongly resemble the resins in their general properties; of these the most important are amber and asphaltum; both of which are used in varnishes, and will be again noticed in their proper places.

The gum resins are principally used in medicine; they are, as their name indicates, mixtures of resins and gums, which exude together from the same tree. They are dissolved in common spirits, which is a mixture of alcohol and water, the former dissolving the resin, and the latter the gum; they are generally turbid when dissolved, soft and brittle when dried, and partially acted on by water; and, being, therefore, unfit to form the basis of varnishes, do not require from us any further notice.

Brilliancy, hardness, and toughness, are essential properties in varnish. These are possessed in very different degrees by the different kinds. Some of the resins employed, possess one of these properties, and some another; from this cause, they are frequently used in a state of combination; a portion of hardness, and of toughness, is frequently sacrificed, to obtain brilliancy. Common rosin, which is the most brittle of all the resins, will communicate a high degree of brilliancy to some of the others; it ought, however, to be very sparingly employed, as it in other respects, deteriorates the varnish. It is very cheap, and easily dissolved, and, from these causes the manufacturer of varnishes, not unfrequently, uses it too freely, to the great injury of the consumer. The toughness of a varnish depends, not only on the kind of resin employed, but also on the solvent. The oil varnishes are the toughest, as the oils themselves, when dried, form very tough, and sometimes very good varnishes, without the addition of any resinous matter.

Varnishes differ greatly in the time required to dry them. Some of the resins retain the spirit in which they are dissolved, much more powerfully than others; the spirit varnishes, however, dry the most readily; some of them, in favourable weather, hardening almost as quickly as they can be laid on. The oil varnishes require a greater length of time, than those made with spirit, and the same kind differs greatly in different specimens. Copal, with linseed oil, will sometimes dry perfectly in an hour or two, whilst other portions will require many days, and even weeks, before they are perfectly hard; as this arises from a difference in the oil, it is a point of manifest importance, to understand the cause of these differences, so as to be able to produce, at all times, such an article as may be wanted. We have, in this paper, made those general remarks, which appeared to be necessary to a right understanding of the subject; the whole article will be of considerable extent, and excepting from some accidental cause, every succeeding number of the Journal will contain an essay, until a complete treatise has been furnished.

Some account of the successful operations performed by Mr. Levi Disbrow, *in boring for water, in the vicinity of the town of New Brunswick, in the State of New Jersey.*

TO THE EDITOR OF THE FRANKLIN JOURNAL.

New Brunswick, June 1, 1826.

Sir,—In your number for April last, you ask for some further particulars respecting the recent well, bored by Mr. Levi Disbrow, in this district. The first writer that brought this beautiful art into notice, named these bored wells, *Central Springs*, not only as being more agreeable to the ear, but as indicative of their origin. The Central Spring, therefore, on Mr. Bostwick's estate, still flows, and even more abundantly than at first. It is brought now by pipes, to the house, to the stables, and to the milk house, and it already brings in a vast profit to Mr. Bostwick, independently of all the various benefits derived from it on his farm. Adjoining him is Mr. Mather's distillery, the works of which, being often imperfectly supplied with water, as to quantity, and *always* as to temperature, it was a thing very desirable to get the surplus water of this Central Spring, which always stands at 52° Fahrenheit, appropriated to its use. An arrangement has, therefore, been made between these gentlemen, by which both are greatly benefitted. By pipes, of *half* the caliber of the main perpendicular tube, through which the water ascends, and inserted in this tube, about four feet *below* the surface of the ground, *one half* of the water goes to supply Mr. Mather's distillery, and the other half furnishes even more than Mr. Bostwick wants for himself. At the depth of four feet, whence the tube now discharges, the water flows at the rate of four gallons, and half a pint, per minute; and, as the distillery is on much lower ground than the place whence the water issues, Mr. Mather gets the full complement. Mr. Bostwick being on higher ground, or rather wishing to get the water to his kitchen and stables, obtains the water at a higher point, by means of a judicious disposition of lateral, and perpendicular tubes, at the rate of one and a half gallons, a minute.

By this arrangement with Mr. Mather, in three years, the cost of the Central Spring will be returned to the spirited gentleman, on whose estate this spring was obtained. This is the second that he has had bored, both of which are now in full operation, and he is certainly entitled, not only to the thanks of the community, but to those of the public at large. So new was the proposal of such a scheme, that few, if any, would have embarked in it, and but for Mr. Bostwick's liberal views and feelings, it is doubtful whether this truly great work, would in our time, have been introduced to the world.

Mr. Levi Disbrow does not affect to consider the art as his own; he knew, and every one knew, that *boring* was a thing known in every part of our western country, and he learned, too, from books, that in Europe, it was *partially* resorted to, when wells became dry; but he considers himself as entitled to the encouragement of the public, because he is the first who formed, and brought to perfection, the plan of bringing fresh water *above* the surface of the ground, for the supplying of farms, and houses.

His eminent success in this, so difficult and new a work, has already drawn forth the attention of those who have been engaged in boring for salt water, and they have encroached on his ground, prematurely; for it should not be disguised from the public, that there is as great a difference between the salt water districts, and those in which the successful experiments have now been made, as there is between the salt and fresh water. Not only a different apparatus for boring, must be used, but the mode of boring is dissimilar; and a salt water borer, can no more use the tools that are necessary to perforate our red freestone and granite, than a manufacturer of clocks, could use those of a watchmaker.

Mr. Disbrow, has overcome all the discouraging obstacles, that beset him in his first trials, and he has reason to hope, that he will ultimately be remunerated for his loss of time and money, in bringing this scheme before the public. He has completed several wells, and is busily engaged with a number of others. He is boring in Albany, Hudson, Horsimus, New York City, Paules Hook, and in your city, near the Northern Liberties, besides a number of other places at the southward. Several experiments have been made by those accustomed to bore in the salt water districts, but they have failed, merely from a want of knowledge of the peculiar geology of the place. Several failures of this kind will tend to bring the art into discredit; it is desirable, therefore, that publicity should be given to Mr. Disbrow's success, that there may be no disappointment.

As to the *practicability* of obtaining water any where, that does not admit of a doubt. The most unpromising spot for the commencement of such a great work, was chosen by Mr. Disbrow. The wells in the vicinity of those with which he began, were from thirty to fifty feet deep, and were very frequently dry; and the water in Brunswick itself, in which two of the Central Springs are located, is brackish and unpalatable. One Central Spring is thirty-seven feet above the level of the Raritan, another is forty-seven, one forty, and two from four to five. It will soon be acknowledged that water can be brought to the surface, by other powers than those of gravitation, or from the pressure principle; but this part of the subject need not now be discussed. An experiment is immediately to be made at Princeton, on the estate adjoining Richard Stockton, Esq.; and this must be a fair trial, as Princeton occupies the highest point in New Jersey. The novel opinion of water rising to the surface, by other agents than those that exist in the creed of our philosophers, was made public in the American Farmer, of Baltimore. Several scientific gentlemen made some remarks on the subject; they were so thoroughly satisfied with the soundness of the received opinion, which has existed for nearly a century, that they did not encourage a single doubt on the question. Since then, it has occupied the thoughts of many who were not only deeply impressed with the truth of the prevailing theory, but bigotted to their belief; they now have their faith shaken, and a few more successful attempts, in discouraging places, will set the matter at rest with them. C.

FRANKLIN INSTITUTE.

Report of the Committee of Inventions, on an Improvement in Carriages, by which accidents may be prevented. By JOHN S. WILLIAMS, ESQ. *of Baltimore.*

The Committee of Inventions of the Franklin Institute, having had referred to them, for their examination, an improvement to prevent accidents in carriages, by disengaging the horses, or locking the wheels; for which improvement a patent has been obtained by John S. Williams, Esq. of Baltimore:

Report, that they have carefully examined the model of a carriage, with these improvements; and that the manner in which the horses are to be disengaged, is as follows. The pole and swingle-tree, are retained in their places, by a pin which passes perpendicularly down through them, by which they are affixed to the carriage; this pin is firmly attached to a spring, which, bearing upon it, keeps it securely in its place; but when this spring is raised, the pin rises with it, and the pole and swingle-tree are disengaged, and the horses, of course, liberated.

To enable the driver to raise the spring with facility, it is terminated by a hook, to which a strap or chain is fastened, the other end of which, may be fixed to the foot board of the driving seat. By pulling this strap, or chain, the disengagement is effected.

For the purpose of locking the wheels, a piece of wood is firmly secured to the perch, or frame work of the carriage, crossing so that the ends terminate within a few inches of each wheel, just within the rim. Upon this piece of wood there are two bolts, sliding through staples; when the wheels are to be locked, these bolts are projected forwards, by two springs, which can be made to bear against them, for that purpose; when projected, the ends of the bolts pass between the spokes of the wheels, close to the felloes, and the wheels are consequently locked. On the front of the foot board, there is a short lever or trigger, with a catch, to which a strap is attached, the other end of which is connected with the springs; by forcing the trigger forward with the foot, the springs are liberated, and act upon the bolts.

This latter apparatus may, undoubtedly, be useful on many occasions, as the driver can lock the wheels, and also liberate them without leaving his seat: the utility of locking, to retard a carriage in descending, or to prevent the horses from running backwards, when ascending hills, is obvious. This can be applied to a carriage with two wheels, where the disengagement of the horse would be inadmissible.

The Committee are aware that the same end has been obtained by other methods. In the year 1802, a patent was granted in England, to Richard Pattinger, for disengaging horses from a carriage, and for an anchor, or drag, to be thrown out to retard it.

At about the same time, a premium was awarded by the Society for the Encouragement of Arts, &c. to William Bowler, for the application of a lever, so as to clip the nave, or hub, of a wheel, to stop its motion.

A patent, with the same date as the first, was obtained by John Lewis, who proposed to lock the wheels by means of a ratchet taking into the nave, or hub of the wheel, and also to disengage the horses.

Another plan was exhibited to the Society for the Encouragement of Arts, &c. by George Davis; in this, the pole was disengaged, and wedges forced forward, so as to press upon the nave or hub, to retard or stop the wheel.

The Committee are informed, that patents have been obtained in this country, for similar objects; but they have never seen any such plan put into operation, nor do they know of any having been made public.

That which has been submitted to them, is much more simple than either of those to which they have alluded, and should it be adopted, particularly in stage coaches, it would, undoubtedly, be the means of preventing many fatal accidents.

Philadelphia, June 17, 1826.

By order,

THOMAS P. JONES, *Secretary.*

Quicksilver Vapour Engine.

"One of the greatest discoveries yet made in navigation has transpired, and the patent has been abandoned in consequence of the technicalities of the Patent Laws. Three-fourths of the fuel now used in steam navigation will be saved. The vapour of quicksilver is substituted for steam, with similar machinery, and a few precautions to prevent any waste of the metal, by a pipe on the safety valve. The bottom of the boiler, which is very small and strong, as compared with that now in use for producing steam, is conical, and the termination of the cone, is in contact with the burning coals which surround it. Their heat is communicated almost instantaneously to the quicksilver in the boiler, throwing it into vapour, at the temperature of 656 degrees of Fahrenheit. Its elasticity and power, can be indefinitely increased by heat, and the greater the elasticity produced, the greater the vacuum in the cylinder, on opening the valve communicating with the well. The saving of stowage will be very considerable, and a ton of quicksilver will be sufficient for propelling a vessel to India, and back again, with an engine of 140 horse power."

We know nothing further of the above, than what appears upon the face of it; we found it in a Journal, and present it to our readers. That it is *possible* to work an engine, with a condensible vapour of any kind, is known to every one who has any pretensions to an acquaintance with the subject; but the eligibility of using quicksilver, appears to us, more than doubtful. The boiler, and also the cylinder in which the vapour acts, as well as all the parts which are immediately contiguous, must be nearly red hot; mercury boils at 656° of Fahrenheit, and it must be somewhat above this point, to keep it in the state of vapour, so as to pass it into the working cylinder; "Sir Isaac Newton ascertained, by a very ingenious set of experiments, that iron is just visible in the dark, when heated to 635°; that it shines strongly in the dark, when raised to the temperature of 752°; that it is luminous in the twilight just after sunset, when heated to 884°; and that when it shines, even in broad day-light, its temperature is above 1000°. From the experiments of Mushenbroeck and others, it appears that what, in common language, is called a *red heat*, commences at about the temperature of 800°."* Probably the temperature of 635° as given above, is rather too low; this appears to be proved by the experiments of Irvine; but let this be as it may, it is evident that the quicksilver engine, must be nearly red hot, when working. It is no easy task to retain the vapour of water in an engine working at 212°, and Mr. Perkins has not been able to make a tight joint, at a temperature of less than half that of the mercurial engine. We are aware that the elasticity of mercurial vapour at 656°, is only equal to that of water at 212°; but the expansion of the metals, would open the joints, and destroy all stuffing, to the pistons, unless they were metallic: but perhaps the inventor, may tell us better.

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* Thomson's System of Chemistry, vol. 1, p. 36, American edition.

Should a vessel, furnished with a mercurial engine, make short voyages, the Doctors might find it convenient, to order a trip to their patients, when salivation was thought desirable; but if sent to the East Indies, we think they would go, to "that bourne, whence no traveller returns."

On the High Pressure Steam Engine.

The following article brings again to our notice, the long talked of Steam Engine of Mr. Perkins. Upon this subject expectation remained so long upon tiptoe, without seeing the promised good, that hope itself had almost become extinct. For ourselves, we never believed that Mr. Perkins had discovered any new principle either as regarded the nature, or the application of steam, and have uniformly expressed that opinion. We have long been convinced that the high pressure principle, is, by far, the most economical, and that when properly constructed, engines in which it is applied, are perfectly safe. Could the junctures in Mr. Perkins' engine be made sufficiently tight, and some other practical difficulties surmounted, the extreme high pressure under which the steam is produced, would insure a great saving in the fuel employed, from the known rapid increase of its elasticity; and the smallness of the generator, is calculated to prevent the loss of a large proportion of that heat, which escapes by radiation, from boilers of the large size usually required. This is all that in our opinion, the engine ever promised; should it perform this, it will be valuable; should it do more, we will confess our error, and shall rejoice in the result.

TO THE EDITOR OF THE LONDON JOURNAL OF ARTS, &c.

Sir,—Mr. Perkins' system of generating high steam, has recently been applied to the Cornish, single-stroke pumping engine, by Mr. Samuel Moyle, civil engineer from Cornwall. Although the engine is not yet complete in all its parts, yet enough has been done to prove its great power, and safety. As to the economy of the fuel, although undoubtedly great, nothing decisive is yet known, owing to the imperfection of the injecting pump, which occasionally failed in giving the full supply of water, upon which the proper supply of steam, wholly depends. Enough, however, has been done to establish the important fact, that the higher the steam is used, the greater is the gain. Steam used at 42 pounds per inch, or at 3 atmospheres pressure, without condensation in the cylinder, is undoubtedly not likely to do more, if so much, as the condensing engine, using steam at 3 or 4 pounds per inch pressure. The eduction side of the piston has not only to overcome the pressure of the atmosphere, but the friction of the steam rushing from the cylinder through the eduction pipe, which will amount to, at least, half an atmosphere more, making 21 pounds resistance: add the friction of the piston, piston-rod, and valves, then there will be very little more pressure, if any, on the inch, than when low condensed steam is used. It would appear that about two-thirds of the 42 pounds pressure on the inch, is lost by the resistance on the eduction side of the piston. But as you increase the pressure of the steam, the gain is almost wholly on the induction side of the piston, since the resistance to the escape of the steam is very little more, whether you work at 500 pounds per inch, or 42 pounds per inch.

The following statements will show the power and safety, although not the amount of the saving of fuel. This engine, with a piston of 9 and $\frac{1}{3}$ inches diameter, and 6 and $\frac{1}{2}$ feet stroke, lifted a column of water 40 inches diameter, and 40 feet high, making 14 strokes of $6\frac{1}{2}$ feet per minute; consuming not more than 120 pounds of coals per hour. But as the engine never worked more than two hours at any one time, it is impossible to say what the actual saving of the fuel would be. After the engine is completed, and worked day after day without interruption, then the economy in the fuel will be clearly ascertained. The area of the pump being 20 times larger than the area of the steam-engine cylinder, and the water being lifted 40 feet high, it balanced the weight or power of 25 atmospheres; but as the friction, &c. must be added to the power required to lift the water, it was found necessary to raise the steam, to about 32 atmospheres, to give a lively stroke to the pump.

The safety of this engine has been proved, by the frequent openings, or fractures, which have taken place, without injuring any one, in the experiments made in generating high steam. The maximum of high steam, has not yet been ascertained; but undoubtedly the higher it can be used, the greater would be the economy. The greater portion of the gain in high steam, appears to be owing to its expansive property. The higher the steam is raised, the sooner the stroke can be cut off; of course more is gained by expansion. The highest Mr. P. has ever used his steam for his steam engines, is 800 pounds to the inch, or about 57 atmospheres.

That the gain goes on in a geometrical ratio, his experiments on the steam gun, have fully demonstrated. In some of those experiments, a pressure of 1600 pounds to the square inch, has been used with perfect safety, and was found to project musket balls of the same weight and distance, one quarter further into the target, than the strongest gunpowder. Mr. P. has made another very curious discovery in experimenting on high steam, namely, that temperature does not always show the true power of the steam, although the steam is in contact with the water from which it is generated, but we cannot be so particular on this point as we could wish, on account of Mr. P.'s not having completed his patent for the remedy.

We feel great pleasure in adding to the above, the testimonials of two gentlemen, whose names are well known in connexion with steam engines.

"We, the subscribers, have for some time past been employed as practical engineers at Perkins and Co.'s Steam Engine Manufactory, in applying Mr. Perkins' system of generating high steam, to the Cornish, single-stroke, pumping engine, of which we have had nearly twenty years practice. From what we have witnessed, we are perfectly satisfied that no danger can be apprehended from explosions. Its great power is established by the fact of its having lifted a column of water 40 feet high, and 40 inches diameter, with a 9⅓ inch piston. As to the economy of fuel, which is evidently great, we cannot exactly say, owing to some parts of the engine being incomplete, especially the injection pump. The longest the engine has worked at any one time was two hours; at that time it was making 14 strokes per minute, 6½ feet stroke, and lifting a column of water 36 feet high, and 40 inches diameter, consuming not more than 100 pounds of coals per hour. We also certify, that Mr. Perkins' flexible steel piston is quite tight, although, at times, working at a pressure of 50 atmospheres.

HENRY HORNBLOWER,
JOSIAH HORNBLOWER."

FROM THE BOSTON JOURNAL OF PHILOSOPHY AND THE ARTS.

Notice of a Work entitled, "Memorial on the Upward Forces of Fluids, and their Applicability to several Arts, Sciences, and Public Improvements: For which a Patent has been granted by the Government of the United States, to the author, EDMOND CHARLES GENET, *a Citizen of the United States; Member of the Institute of France; of the Royal Antiquarian Society of London; of the Philosophical Society of New York, &c. &c."*

None, more than ourselves, believe that great discoveries are rare. We mean those discoveries, which, in their consequences, improve the physical condition of man, by supplying his wants with less labour, and thus giving him a portion of his time, in which to cultivate his intellectual and moral powers. One of the most sensible questions, in our opinion, that was ever asked regarding the importance of a discovery, was, "Will it reduce the price of grain?" The memorial of Mr. Genet professes to make us acquainted with one of this character; it professes no less than to add another, to the forces, already within the control of the engineer and the manufacturer, which, like the steam-engine, (that it is intended to render obsolete,) may give motion to the thousand complicated devices of human art. We were not born yesterday, and have therefore had an opportunity of knowing that men oftentimes deceive themselves, and sometimes others, into a belief that their discoveries are of greater value than a succeeding age assigns to them. Persons so deceived, however, are, commonly, men of undisciplined minds, men who have not stood before rivals and critics, rising in their despite, to rank with the philosophers and sages of the earth. The author of the book before us, however, is not a nameless man. He is a member of the French Institute, and was, as he informs us, "affiliated to the Academy of Sciences in 1783," before Lavoisier, La Place, or Davy, were known to the world; when, therefore, such a man informs us, that after forty years reflection, he is about to enlighten us upon a subject, which of all others he has chosen and kept nearest to his heart, we should be lost to humanity, did we not take up his book with a respectful attention.

"The upward forces of fluids!" What can this mean? but let the author speak. "In my meditations on the homogeneity of the forces usually applied to mechanics, I have viewed with astonishment that the force of levity, or the upwards force, should have been entirely overlooked or neglected, when Newton himself had admitted the existence of a drawing force opposed to the force of gravity, which prevents the moon from falling upon the earth; when Herschel had calculated that the force of levity, as exhibited by caloric, was such that it moved in every direction at the rate of 200,000 miles in a second; when the smoke and the vapours of the earth manifested, by their ascension through the atmosphere, that they were impelled by a force acting inversely to the force of gravity; when that same force, which chemistry has proved to be due to caloric, latent or sensible, was known to be the cause of the ascension of balloons; when those aerostatic machines were seen to raise heavy weights in a different tangent from the force of gravity; when the report of the bold adventurers who raised themselves in the air, by means of those aerostats, had testified that equally independent of the general laws of atmospheric pressure and aerometry, the elasticity of aerostats, and the accelerated motion of their ascension, increased as the air grew lighter, and the atmospheric pressure decreased; when it was also stated by them, that as they approached the upper strata of the atmosphere, perhaps occupied by an ætherial gas, at the altitude of 3670 rods, the highest to which men ever have ascended, above the geological crust of the globe, the spirit of life itself seemed to be drawn upwards and to become evanescent, retaining no recollection on its return to vital air, of what had happened during its lipothymy; and when finally it had been proved that the laws of gravity varied in the same body, in proportion of its degree of heat or cold, as it is evinced under the equator and the colder latitudes towards the poles, by the pendulum, retarded when rendered specifically lighter and bulky *by caloric*, or accelerated, when rendered heavier and contracted *by cold*."

Leaving out the theory of the variation of the pendulum, as an extraneous bee in the author's bonnet, the foregoing grotesque paragraph, contains the intellectual germ, which is expanded into the volume of Mr. Genet. The "force of levity" becomes in his skilful hands, a sort of man-of-all-work, that carries canal boats from level to level, without water, raises stranded vessels, recovers foul anchors, saves drowning men, navigates seas, rivers and lakes, and at length disappears in a flying machine that would have delighted the heart of Bishop Wilkins himself. The manner of performing all this, is put down in letter-press, and illustrated by engravings. Take an example. "The moving force," to carry a canal boat to a higher level, "of this machinery is to be essentially the ascensive force of an ærostat [balloon] of a spheroidal form, which, when disengaged and allowed to ascend, will exercise its power on the large wheel, by the means of a rope fastened to its appendice [bottom] that will pass through a sheeve at the bottom of the pit, to a groove on the rim of the large wheel, and embrace its circumference. The large wheel will besides be supplied with handspikes, to accelerate or retard its motion, or use it separately; and also with a pall, to prevent the load from descending whenever requisite, as it will hereafter be explained. The large wheel, is to be 30 feet diameter and 90 circumference, [in the time of *Metius* every thing of 30 feet diameter had a circumference of something more than 94 feet; but, *nous avons changè tout cela,*] which proportions will give fifteen revolutions of the drum, while the large wheel will perform only one." If this is not intelligible, the reader will understand it when we inform him, that the apparatus consists of wheel work moved by the ascent of a balloon, which, after having risen forty feet, is, we are given to understand, "to be recalled down" by "the individual force of the large wheel," and made to perform a new ascent. But why not use the *descendent* force of a leaden weight, as well as the ascensive force of an air-balloon, to "be recalled up," in the same way that the other is recalled down? or better yet, why not carry up the boat by the "individual" exertion of a horse or a steam-engine, as one Robert Fulton proposed a great while ago?

Another specification of the application of the "upward forces of fluids," is, to the navigation of seas, lakes and rivers. Here Mr. Genet's apparatus, assumes a somewhat different form. The balloon or aerostat, which before floated in air above, has now become a hydrostat, and works in "the floods below." As this new application is founded on an experiment, it may be worth our while to relate it. Mr. Genet took "a small hollow balloon shaped like an oblong spheroid, made of tin, containing in its cavity ½ cubic foot." "Several experiments have been made with this simple *hydroaerostatometre,*" which prove, "That the uplifting force of salt water exercised against the balloon filled with nothing but atmospheric air, supported 47 pounds; which, with the three pound weight of the balloon and its appendages, the weight of the cup and friction of the pullies, amounting altogether to 5 pounds, gives to the upward pressure of salt-water against the inferior surface of ½ cubic foot of atmospheric air so contained, an uplifting force of 54 pounds, and to a cubic foot 108 pounds." pp. 36. 37. This is very important, as a foot of salt water weighs about 64 pounds, and it has been heretofore supposed, that no substance, although devoid of weight, plunged under water, could tend to rise with a force greater than the weight of an equal volume of water; but "*nous avons changè tout cela,*" again. The apparatus which Mr. Genet has contrived, is, as we take it, a *perpetual motion,* and the learned person at the head of the Patent-office, ought, from the rules which he prescribed to himself, some years since, to have refused a patent for it, until Mr. Genet *made it go.*

But the best part of the "Memorial," is the description of the flying apparatus, carrying up two horses to *move its wings,* and fly

> "With restless violence,
> Round about the pendant world."

The author says, "in order to form this new plan, I have consulted nature, which offers in every thing the best, and most perfect models; and I have ascertained by numerous observations, that the plainest way to perfect aeronautics, was to imitate, as nearly as possible, the innate faculty with which nature has endowed the birds and the fishes, to enable them to raise, propel and guide themselves in the fluids, in which they are immersed." p. 68.

Now his imitation of nature, is in the form of a monstrous balloon, which is to be loaded with a windmill and two horses, three men, their attendants, a chemical apparatus, an anchor, fodder and provender, water, provisions for the men, and errors and omissions to the amount of 13,400 pounds. This is an imitation of the innate faculty, with which nature has endowed birds and fishes, with a vengeance.

Our readers are already sufficiently initiated in the mysteries of the "upward forces of fluids," from the specimens here presented. Few of them we apprehend will follow our unprofitable example, for we have honestly read the *Memorial*, from beginning to end.

The work, to which the above "notice" refers, was lately placed in our hands, with a request that we would make such observations upon it, as we might find it to merit. After looking over every page of it, with some care, though we confess we had not the patience of our brother of Boston, who "honestly read it from beginning to end," we were in no small strait; for although the book certainly excited our *admiration*, it could not elicit our praise. If it has any merit, it is as a work of *fancy*, but for this, it is not supposed the author intended it. We were, however, unwilling to interfere with the whimsies, and to disturb the reveries of a very respectable man, who, probably, has cherished fond hopes of this child of old age; it was the more unpleasant to us, as we have had some personal knowledge of the gentleman, and have esteemed him highly. Under these circumstances we had taken up the pen, but the ink would not flow freely; whilst thus engaged, the postman brought the Boston Journal, which happily relieved us from our dilemma, as it supplied us with the foregoing article, in which we found our own thoughts more happily pourtrayed, than the picture would have presented them, had it been drawn by ourselves.

We have also, in our possession, a "*Description of a Guard or Fender, to protect steam-boats against snags, planters, sawyers, shoals, rocks, &c.*" for which a patent has lately been obtained by Mr. Genet. The contrivance is very simple, but we apprehend that it would be found to be altogether ineffectual. He proposes to place a fender of wood, or of iron, so as to project beyond the stem of the boat; this is to terminate in an obtuse angle, and to be attached to two sliders, which slide under the boat, and allow it to retreat, when it strikes against any obstacle. In its retreat, it is resisted by weights, attached to chains, which pass over pulleys; and these weights, force the fender forward. A bell is to be fixed, so as to ring by the motion of the chains, whenever the fender encounters any resistance. This is a fair, and we hope, a distinct outline of the contrivance. Snags, we believe, usually pass through the bottom of a boat, after the bows have been lifted over it, by the motion of the waves, and this the fender could not prevent, unless placed lower down than would be found eligible; against other obstacles, the momentum of a steam-boat, under way, would hardly be defended by the *guard*, and we fear that "the bell" would always ring too late. [*Editor.*

On the Nature and Properties of Timber, extracted from "The Elementary Principles of Carpentry. By THOMAS TREDGOLD."

Wood, is that substance which forms the principal part of the roots, trunks, and branches, of trees and shrubs; and its usefulness in building, and in the mechanical arts, is well known.

The *woods* of different trees differ much in strength, hardness, durability, and beauty, and consequently, in their fitness for the various purposes to which they are applied. The wood which is felled and seasoned for the purpose of building is called *timber;* and in stating the properties of woods, I shall consider those only which are fit for timber.

If the stem, or trunk of a tree, be cut across, the wood is found to be made up of numerous concentric layers, or rings; very distinct in some trees, but less so in others. One of these layers is formed every year; consequently their number corresponds nearly with the age of the tree. Each layer consists, in general, of two parts; the one solid, hard, heavy, and dark coloured; the other of a lighter colour, porous, and soft; which renders the lines of separation, between the annual layers, distinct. Scarcely any two layers of the same tree are precisely alike, either in the proportion of the hard part, or in the thickness of the layers; as the layers vary in thickness, according to the degree of vegetation which took place in the years of their formation: and also in the same tree they vary in thickness, either according to the situation of the principal roots, or the aspect; the annual layers being always thicker on that side of the tree, which has been most favourable to the growth of the roots, or that has had the advantage of a good aspect.

The structure of wood, and the nature of the vessels through which the fluids move, in the living plant, are not thoroughly understood: indeed the study of vegetable anatomy is attended with considerable difficulties; but some important facts have been ascertained, that contribute materially towards a more perfect knowledge of the nature and properties of wood.

Wood, appears to be composed of various vessels, which, in the living tree, convey the fluids necessary to its growth; between those vessels, there are cells interposed. There is nothing of the character of solid fibres in wood, except the thin membraneous coats of the cells and vessels, which adhere so slightly together in recently formed wood, that it is easy to separate them. The vessels in the growing tree, are intended to convey a watery fluid, called the sap, from the roots to the leaves; when it arrives at the leaves, it undergoes some changes, and returns through the bark; and the bark being expanded by this accession of moisture, rises from the wood, and leaves a cavity that becomes filled with the returning sap, which gradually hardens and forms a new layer of wood. The rising sap flows chiefly through the annual ring, next the bark; and from the experiments of Mr. Knight it appears, that the sap during its ascent dissolves some portion of a substance that had been deposited in the vessels of the wood during the preceding winter, for the nourishment of the buds, leaves, and young wood; hence the flowing sap is more dense in the upper, than in the lower part of a tree. Dr. Darwin draws a like conclusion from the de-barked oaks producing leaves.

In trees, as the leaves expand, the sap ceases to flow, and the bark again adheres to the wood; and from the middle of June, to the middle of August, there appears to be a pause in vegetation; but after this period, the sap again begins to flow, and the bark which adhered so closely in the preceding months, may be separated as easily as in the spring.

The sap which rises through the wood, from the roots, is very different in its nature, from that which descends through the bark to form the new layer of wood. That which ascends, is nearly as liquid as water, and is called the *common sap*. It has, in general, a sweetish taste, and contains sugar and mucilage. It always contains an acid, sometimes in a free state, sometimes combined with lime or potash. When this sap is left to itself, it soon ferments and becomes sour; and when the proportion of sugar is considerable, it will undergo the vinous fermentation.

The descending sap, called the *proper sap*, differs so considerably in different trees, and is so difficult to procure in a separate state, that its properties have not been much examined. It is always less liquid, and contains a much greater proportion of vegetable matter, than the common sap. It is also very probable that trees of the same kind, produce proper sap of different qualities, in different climates, as we find the facts established respecting timber, the growth of one climate are not applicable to the same species of timber, grown in another climate.

That part of the wood next the bark, is called *sap-wood*, because it is through it, chiefly, that the sap ascends; and as it is shown by Mr. Knight to contain the vegetable matter to be expended in forming leaves and buds, it is reasonable to suppose that the sap-wood must be more prone to decay, than the internal part of the tree, called the heart-wood.

As trees increase in size, the oldest part of the sap-wood gradually loses all vegetable life, and the more fluid parts of it, are either absorbed by the new forming sap-wood, or evaporated: its vessels and cells become closed by the pressure of the new forming wood, and it ceases to perform any other part in the growth of a tree than to support it. When these changes have taken place, it is found to be more compact, and generally of a darker colour; and also contains only a small proportion of vegetable matter, besides that kind which is called the *woody fibre* by chemists. It is then heart-wood, or wood in its most perfect state.

The sap-wood is softer, and generally lighter coloured, than the heart-wood, and contains a considerable portion of vegetable matter, that partakes of the nature of the sap which ascends through it. It is found to decay rapidly, and is also very subject to worms. The reason is obvious, for it contains the food which they live upon, and which is absorbed, or evaporated, from the heart-wood.

The proportion of sap-wood in different trees varies very much: Spanish chesnut has a very small proportion of sap-wood, oak has more, and fir a still larger proportion than oak; but the proportions vary according to the situation and soil. Three specimens of a medium quality, gave the following:

Chesnut, whole age	58 years,	15½ inches diameter,	7 years sap-wood,	⅜ inch thick.
Oak, whole age	65	17	17	1¼
Scotch fir		24		2½

Therefore, if the diameter be unity, or 1, that part of it which is sap-wood, will be, in the chesnut, 0.1; in the oak, 0.294; and in the Scotch fir, 0.416. The Scotch fir was the produce of the Mar Forest.

The life of trees, like that of men, has been commonly divided into three stages; infancy, maturity, and old age. In the first, the tree increases from day to day; in the second, it maintains itself without sensible gain or loss; but, in the third, it declines. These stages vary in every species, according to the soil, the aspect, the climate, or the nature of the individual plant.

Sir H. Davy states, that oak and chesnut trees, decay sooner in a moist soil, than in a dry and sandy one; and their timber is less firm. The sap-vessels being expanded with moisture without the necessary degree of nourishing matter, the general texture becomes necessarily less firm. Such wood splits easily, and is very liable to shrink and swell, with the changes of the weather.

Trees of the same kind, arrive at the greatest age, in that climate which is best adapted to their nature. The common oak, the fir, and the birch, thrive best towards the north; the ash and the olive tree, thrive best towards the southern parts of Europe.

We find, says Mirbel, the ashes of Calabria and Sicily to be longer lived, than those of Prussia or Great Britain. Oak and chesnut trees, under favourable circumstances, sometimes attain an age of about 1000 years; beach, ash, and sycamore, seldom arrive at half that age.

The decline of trees, appears to be caused by the decay of the heart-wood; and it is this, as Sir H. Davy remarks, that seems to constitute the great limit to the age, and size, of trees.

In trees that have not arrived at maturity, the hardness and solidity of the wood, are greatest at the heart, and decrease towards the sap-wood; but in the mature or perfect tree, the heart-wood is nearly uniform; while that of a tree on the decline, is softer at the centre, than it is next the sap-wood. These observations were made by Buffon in the course of his numerous experiments, and also by Duhamel.

Of Felling Timber.

"It should be," says the venerable Evelyn, "in the vigour and perfection of trees, that a felling should be celebrated." When a tree is felled too soon, the greater part of it is sap-wood, and in a young tree, even the heart-wood has not acquired its proper degree of hardness; indeed the whole tree must partake so much of the nature of sap-wood, that it cannot be expected to be durable. And when a tree is not felled till it be on the decline, the wood is brittle and devoid of elasticity, tainted, discoloured, and soon decays. But in trees that have arrived at a mature age, the proportion of sap-wood is small, and the heart-wood is nearly uniform, and is hard, compact, and durable. Hence it is important that Evelyn's precept, should be carefully attended to. It is true, the proper age for each species, has not been satisfactorily determined, but it is a point where great accuracy is not necessary; for half a dozen years in the age of a tree, will not make much difference, provided it be not cut too soon. It is against cutting trees before they have arrived at maturity, that I most protest; and as it is most likely to happen from interested motives, it is the more necessary to caution the carpenter in this respect. Trees increase slowly in size, after they arrive at a certain age, therefore it is the interest of the timber grower, to fell them before they arrive at maturity; because it is his object to obtain the greatest possible quantity of timber, without regard to the quality. But when the carpenter is sensible of the inferior quality of young timber, in respect to duration, it is his province to check this growing evil, by giving a better price for timber that has acquired its proper degree of density and hardness.

The period generally allowed for an oak tree to arrive at maturity, is 100 years, and the average quantity of timber produced by a tree of that age, is about 1½ loads, or 75 cubic feet. In some instances oak trees arrive at maturity, in a less time than 100 years, and in others not till after that period.

The age of an oak tree, according to Daviller, should never exceed 200 years, nor should it be felled at a less age, than 60. Belidor states about 100 to be the best age for the oak. It is much to be regretted, that in districts where the oak flourishes, it is seldom suffered to attain a mature age; being often cut before the trees will produce 50 feet of timber each.

The ash, larch, and elm, should be cut when the trees are between 50 and 100 years old; and between 30, and 50, is a proper age for poplars.

The Norway spruce, and Scotch pine, are generally cut when between 70 and 100 years old in Norway.

In order that timber may be durable, it is also necessary to attend to the proper season of the year, for felling. But on this point, there is much difference in opinion, and it is only to be decided by attending to the state of trees, at different seasons of the year. The most proper period for felling timber, is undoubtedly that in which it is most free from extraneous vegetable matter, or such matter as is intended to be expended in leaves and buds, and which is of a more saccharine and fermentible nature than the proper juices, or such as form the wood. A tree deposits in the sap-wood, and also in that part of the heart-wood which adjoins it, a portion of matter to be dissolved by the rising sap, and at the period when the leaves are putting forth, the wood must be filled with matter in a state ready for germination; consequently the timber cut at that period, must be easily acted upon by heat and moisture, and subject to rapid decay; or to be destroyed by worms. Now there are two periods in the year, the spring and autumn, when trees are in a state of vegetation; therefore, at these times, it is desirable to avoid felling timber for any other than temporary purposes. Of these periods the spring must be the worst, because then trees contain the greatest quantity of matter, in a state fit for germination.

On the other hand, the best time for felling timber is in mid-winter, or mid-summer; as at these times, the vegetative powers are at rest, or have expended all the most changeable parts, in producing leaves, &c. In some kinds of trees a little after mid-summer appears to be decidedly the best time for felling. Alder felled at that time, is found to be much more durable; and Ellis says, that beech, when cut in the middle of summer, is better, and less liable to worm-eat; particularly if a gash be cut to let out the sap, some time before felling. And as summer felling is an advantage in some species, it seems reasonable to conclude that it will be so in all.

But in oak trees, the bark is too valuable to be lost; and as the best period for the timber, is the worst for the bark, an ingenious method has been long partially practised, which not only secures the bark at the best season, but also materially improves the timber. This method consists in taking the bark off the standing tree, early in the spring, and not felling it till after the new foliage has put forth, and died. For by the production of new buds, the fermentible matter is expended, and the sap-wood becomes nearly as hard and durable as the heart-wood, being both less liable to decay, and to be destroyed by worms.

Buffon has ascertained, by experiment, that the wood is materially improved by this method of barking the trees standing in the spring, and felling them about the end of October. Duhamel, whose extensive knowledge of the nature, and qualities of woods, is well known, recommends the same method; and Evelyn states, that "to make excellent boards and planks, it is the advice of some, you should bark your trees in a fit season, and so let them stand naked a full year before the felling." But a tree will not be benefitted by standing so long; and the best time for felling appears to be when the new foliage has put forth and died, as Mr. S. Pepys observes in his paper on the subject. I am happy to be able to add, that Mr. T. A. Knight, to whom we are indebted for many interesting, as well as important facts, respecting timber, has made some experiments and observations, from which he concludes, that in all cases where it is essential to give durability to the sap-wood of oak, the trees should be barked in the spring, and felled in the ensuing winter.

When the bark of a tree is not of sufficient value to defray the expense of stripping, the timber should be felled during the months of

December, January, and February, in the winter; or during the month of July in the summer. Winter felling, is recommended by most writers. According to Vitruvius, the proper time for felling, is between October and February; and he directs that the trees should be cut to the pith, and then suffered to remain till the sap be drained out. The effusion of the sap, prevents the decay of the timber, and when it is all drained out, and the wood becomes dry, the trees are to be cut down; when the wood will be excellent for use.

A similar effect might be produced by placing the timber on its end as soon as it is felled, and it would no doubt compensate for the extra expense by its durability in use.

In France, so long ago as 1669, a royal ordinance limited the felling of naval timber, from the 1st of October, to the 15th of April. Buonaparte directed that the time for felling naval timber should be abridged, to, from the 1st of November to the 15th of March, in order to render it more durable.

(TO BE CONTINUED.)

On the Preparation of Ivory Paper, for the use of Artists. By Mr. S. EINSLE.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

The properties which render ivory so desirable a substance, for the miniature-painter, and other artists, are, the evenness and fineness of its grain; its allowing all water-colours laid on its surface, to be washed out, with a soft wet brush; and the facility with which an artist may scrape off the colour from any particular part, by means of the point of a knife, or other convenient instrument; and thus, heighten and add brilliancy to the lights in his painting, more expeditiously and efficaciously, than can be done in any other way.

The objections to ivory, are, its high price, the impossibility of obtaining plates exceeding very moderate dimensions, and the coarseness of grain, in the larger of these; its liability, when thin, to warp by changes of the weather; and its property of turning yellow, by long exposure to the light, owing to the oil which it contains.

The candidate produced before the Committee, several specimens of his ivory paper, about an eighth of an inch thick, and of superficial dimensions, much larger than the largest ivory: the surface was hard, smooth, and perfectly even. On trial of these by some of the artists, members of the Society, it appears that colours may be washed off the ivory paper, more completely than from ivory itself, and that the process may be repeated three or four times on the same surface, without rubbing up the grain of the paper. It will also, with proper care, bear to be scraped with the edge of a knife, without becoming rough.

Traces made on the surface of this paper, by a hard black-lead pencil, are much easier effaced, by means of India rubber, than from common drawing paper; which circumstance, together with the extremely fine lines, which its hard and even surface is capable of receiving, peculiarly adapts it for the reception of the most delicate kind of pencil drawings, and outlines.

An artist of eminence in miniature-painting, (not a member of the Society,) stated, that he has frequently used the ivory paper, and finds it to be superior to ivory itself, in the whiteness of its surface, in the facility with which it receives colour, and in the greater brilliancy of the colours, when laid on, owing to the superior whiteness of the ground. Colours on ivory are apt to be injured, by the transudation of the animal oil, a defect, from which the ivory paper is free.

Some highly respectable dealers in drawing materials, stated, that they have had samples of the ivory paper in their possession for a conderable time, and that it does not appear to become yellow, or discoloured, by keeping.

The valuable properties of the paper appearing thus to be satisfactorily established, a day was fixed for the candidate to disclose his process, and to prepare a specimen of the paper in presence of the Committee. Accordingly, at the appointed time, Mr. Einsle attended, and exhibited before the Committee, his method of preparing the paper: he also gave, in a written account of the process; from which, and from the information obtained during the sitting of the Committee, the following account has been drawn up.

Take a quarter of a pound of clean parchment cuttings, and put them into a two-quart pan, with nearly as much water as it will hold; boil the mixture gently for four or five hours, adding water from time to time, to supply the place of that driven off by evaporation; then, carefully strain the liquor from the dregs, through a cloth; and, when cold, it will form a strong jelly, which may be called, size No. 1.

Return the dregs of the preceding process into the pan, fill it up with water, and again boil it as before, for four or five hours; then strain off the liquor, and call it size No. 2.

Take three sheets of drawing paper (outsides will answer the purpose perfectly well, and, being much cheaper, are therefore to be preferred,) wet them on both sides with a soft sponge dipped in water, and join them together with the size No. 2. While they are still wet, lay them on a table, and place upon them a smooth slab of writing slate, of a size somewhat smaller than the paper. Turn up the edges of the paper, and glue them on the back of the slate; and then allow the paper to dry gradually. Wet, as before, three more sheets of the same kind of paper, and *glue* them on the others, one at a time, carefully removing all air-bubbles, by wiping from the centre outwardly; cut off, with a knife, what projects beyond the edges of the slate; and when the whole has become perfectly dry, wrap a small flat piece of slate, in *coarse* sand-paper, and with this rubber make the surface of the paper quite even and smooth. Then, glue, on an inside sheet, previously wetted, which must be quite free from spots, or dirt of any kind; cut off the projecting edges as before; and, when dry, rub it with *fine* glass-paper, which will produce a perfectly smooth surface. Now, take half a pint of the size No. 1; melt it by a gentle heat, and stir into it three table-spoonfuls of fine plaster of Paris;

when the mixture is completed, pour it out on the paper, and, with a soft wet sponge, distribute it as evenly over the surface as possible. Then allow the surface to dry slowly, and rub it again with fine glass-paper. Lastly, take a few spoonfuls of the size No. 1, and mix with it three-fourths its quantity of water; unite the two by a gentle heat, and *when the mass has cooled, so as to be in a semi-gelatinous state*, pour about one-third of it on the surface of the paper, and spread it evenly with the wet sponge: when this has dried, pour on another portion, in the same manner, and spread it; and afterwards the remainder, and diffuse it uniformly; when the whole has again become dry, rub it over lightly with fine glass-paper, and the process is completed; it may, accordingly, be cut away from the slab of slate, and is ready for use.

The quantity of ingredients above mentioned is sufficient for a piece of paper seventeen and a half inches by fifteen and a half.

Plaster of Paris gives a perfectly white surface; oxide of zinc, mixed with plaster of Paris, in the proportion of four parts of the former, to three of the latter, gives a tint very nearly resembling ivory; precipitated carbonate of barytes, gives a tint intermediate between the two.

Description of a simple Punt-Boat for saving time and labour. By ANDREW WADDELL, Esq. F. R. S. E.

It is sixty feet long, sixteen feet broad, and four and a half feet deep. It carries its lading upon deck, and it is for the purpose of transporting stones, and other materials, for constructing wears, or breakwaters, and for removing obstructions in dry, and bar, harbours.

In the interior of the boat, below deck, there is a water-tight space, built on one side, occupying about one-third of the breadth of the boat, and the whole of the length, which space, has no connexion with any other part of the interior.

In the bottom of this space, there is an opening with a valve, to shut at pleasure, capable of admitting as much water in one minute, as will sink down that side of the boat, and raise the other; thereby forming an inclined plane, and admitting of the stones, or other material on the deck of the boat, sliding easily overboard into the water, after the manner in which a loaded cart is emptied.

The boat will then instantly resume, nearly, its upright position, and the valve being left open, the water that was admitted into the above mentioned space, will run out again to the level of the water without. The valve is then to be shut, and any water that remains in the said space, pumped out in a few minutes, by means of a wide chambered pump, and the aid of one man.

A boat of this construction will be most useful in forming breakwaters, by dropping the stones at high water, or at any time in deep water, exactly on the spot wanted; but the above mentioned valve, should be made to open and shut with a screw, so that, should the lading be required to be put overboard at different parts, the side of the boat might be sunk no further, than to admit of a man sliding the stones down one after another.

This boat, when light, draws about one foot and ten inches, and when loaded, about four feet water, which difference of two feet and two inches, when immersed, will displace a body of water equal to thirty-six tons weight, or more.

The bilge keels, attached to the bottom of the boat, are for the purpose of preventing, in some measure, its flat bottom from coming in too close contact with the mud, when deeply laden, which otherwise might prevent the boat from rising with the flood tide, when grounded in such situations; and these bilge keels being firmly united to the bottom of the boat, serve to strengthen the whole of its frame.

[*Edinburgh Journal.*

Different Illuminating powers of strained and unstrained Oil.

Sir,—To your very useful and interesting publication I have been an original and constant subscriber, and have to thank it for many hints which have proved very serviceable to me in the adoption. I therefore owe it much. In part payment thereof, I beg to notice a trifling occurrence which has lately come under my immediate observation, for which I cannot satisfactorily account, and which I do not remember to have seen any where noticed.

I am in the constant, and nightly, habit of burning one of the sinumbra lamps, as I very much prefer its light to that of a candle. I use the best sperm oil that I can obtain. Last spring, having nearly consumed the supply which I had provided for the winter's use, and finding that, towards the bottom of the can, the oil was become thick, and would not burn with so good a light as heretofore, I strained that which remained through a thick flannel, which operation appeared to my eye, only to remove the thick and feculent matter which it contained, the oil which passed through being perfectly clear and pellucid. This *strained oil*, to my astonishment, would not burn in my lamp. Thinking that the fault might rest with the lamp, and that probably it might want cleaning, I sent it up to town for that purpose; when it returned I again tried to burn the same oil, but without success: I then emptied the lamp and introduced a supply of *unstrained oil*, which burned as well as I could wish. Since then I have given the strained oil to my servants, to burn in the stables in a common open tin lamp, with a common cotton wick: they too failed in being able to make it burn, the flame dying away as soon as the wick had burned for a few seconds. The *rationale* of this I wish to account for.

I am, Sir,
Yours respectfully,
Agricola.

[*Lond. Mech. Mag.*

The Editor has been induced to republish the foregoing notice, from the London Mechanics' Magazine, in consequence of having, in several instances, experienced a similar result, from straining oil.

He has used a night lamp, with a very small wick, requiring very good oil. Sometimes, when the oil has become thick, the lamp would require trimming in the night; upon straining the same oil, some change was produced in it, which altogether prevented its burning, the lamp going out very quickly: he has been at a loss to account for this, but of the fact, he is quite certain.

Measuring the contents of Cylindrical Vessels.

Sir,—The following easy method of ascertaining the contents of *any cylindrical vessel*, in gallons, was communicated to me by the late Dr. Evans, the mathematical master of Christ's Hospital.

I have a long time employed this rule to verify my purchases of *oil*, and it has saved me money by detecting errors; and I hope, when known, it will be of service to others.

Rule.—Multiply the diameter of the cylinder by itself; that product, multiply by the depth *in inches* and decimal parts; lastly, multiply this last product by the decimal ,0034, and from this product cut off as many figures as there are decimals in the whole, and the figures or whole numbers are gallons, and the decimals are parts of a gallon.

Example.—Suppose a cylindrical vessel to measure 21,5, say twenty-one inches and a half diameter; and the depth of the oil or other fluid is 76,25 inches, say seventy-six inches and a quarter.

Multiply - - - - 21,5 the diameter.
by itself - - - - 21,5

1075
215
430

46225
Multiply by the depth - - 76,25

231125
92450
277350
323575

352465625
Decimal fraction - - ,0034

1409862500
1057396875

119,83831250

gals. qts. pint.
Answer - - - 119 3 0½

One hundred and nineteen gallons, three quarts, and one half-pint.

N. B.—To measure the depth of the fluid you should have a rod marked with inches and parts, but any plain rod dipped into the fluid, and accurately measured to the point of immersion, will be sufficiently accurate. C.

[*Ib.*

On Preparing Oil for Watchmakers.

It cannot but be known to all how much the quality of the oil, used by watchmakers for oiling the works of their delicate machines, is of importance to them.

Colonel Beaufoy remarked, that if olive oil be exposed to the rays of the sun for a considerable length of time, it becomes colourless, clear, like water, free from mucilage, and does not easily freeze. This effect was produced by exposing two half-pint phials nearly filled with oil to the sun-beams for a couple of years; the bottles were uncorked occasionally to let out the gas.

Chevereul has recommended the following process for freeing oil, for the use of watchmakers, from any acid or mucilaginous matter. Put some salad oil into a matrass, or one of the Florence flasks in which it is imported, and pour on it eight times its weight of spirit of wine; heat the mixture until it is ready to boil, then pour off the spirit of wine, and let it stand to cool. A portion of solid, fatty matter, called stearine, separates, and is to be taken away; and then the spirit is to be evaporated away in a basin, or distilled in a glass retort, until only about one fifth part is left; by this means the fluid part of the oil or elaine, as it is called, will be separated and deposited. This elaine ought to have the consistence of oil, be colourless, with little or no taste or smell; it should not discolour litmus paper, neither should it be easily congealable by frost.

On Proving the Colours of Dyed Stuffs.

Proofs are either natural or artificial. The natural proof consists in exposing the dyed stuff to the air, sun, and rain. If the colour is not changed by this exposure, in twelve or fourteen days, it may be considered as fixed. This proof, however, is not adapted for every colour; because some colours will stand this proof, and yet fade in consequence of the application of certain acids; and there are other colours that cannot resist the natural proof, and yet remain unchanged by acids.

Colours, therefore, may be arranged in three classes, and to each of them a different kind of artificial proof is alloted. The first class is tried with alum, the second with soap, and the third with tartar.

For the proof with alum, half an ounce of that salt is dissolved in a pint of water in an earthen pipkin, and into this put half a quarter of an ounce of the dyed thread or stuff that is to be tried; and the whole being boiled for about five minutes, it is then washed with clean water. In this manner are tried crimson, scarlet, flesh colour, violet, ponceau, peach-blossom colour, different shades of blue, and other colours bordering upon these.

For the proof with soap, a quarter of an ounce of soap is boiled in a pint of water, and half a quarter of an ounce of the dyed thread, or stuff that is to be tried, is put into the liquor, and suffered to boil for five minutes. With this proof all sorts of yellow, green, madder, red, cinnamon, and similar colours are tried.

For the proof with tartar, that substance must be pounded very small, that it may be more easily dissolved; an ounce is then boiled in a pint of water, and a quarter of an ounce of dyed thread, or stuff, is boiled in the solution for five minutes. This proof is used for all colours bordering upon the fallow, or hair brown.

Minimum of Adhesion in Steel, &c.

It is a fact perhaps not generally known to those who have written on the subject, that at the heat called black heat, but which is, in fact, nearly, or quite a red heat in the dark, steel is broken or separated by fracture with much less force than when heated *more, or less*, the requisite temperature varying probably in proportion to the carbon contained in the steel. The disposition to be easily separated by fracture, at a particular heat, exists in carbonated or cast iron, in the alloys of copper and of tin, and is very perceptible in flint glass, and perhaps in all factitious metallic compounds, some requiring a moderate, and others a more intense heat.—*Silliman's Journal.*

Method of Clearing Trees from Worms, Caterpillars, &c.

The following method of driving worms, caterpillars, and all other sorts of insects, from trees, has lately been practised with singular success:—Bore a hole into the trunk of the tree, as far as the heart; fill this hole with sulphur, and place in it a well-fitted plug; a tree of from four to eight inches diameter, requires a hole large enough to admit the little finger, and in the same proportion, for larger or smaller trees. This will usually drive the insects away in the course of forty-eight hours, but uniformly succeeds, perhaps sometimes after a longer period.—*Ib.*

On clearing Feathers from their Animal Oil.

BY MRS. JANE RICHARDSON.

From the Transactions of the Society for the Encouragement of Arts, Manufactures and Commerce.

Take, for every gallon of clean water, one pound of quick-lime; mix them well together; and, when the undissolved lime is precipitated in fine powder, pour off the clear lime-water for use, at the time it is wanted. Put the feathers to be cleaned into another tub; and add to them a quantity of the clear lime water, sufficient to cover the feathers about three inches, when well immersed and stirred about therein.

The feathers, when thoroughly moistened, will sink down, and should remain in the lime-water three or four days; after which, the foul liquor should be separated from the feathers, by laying them on a sieve, to drain.

The feathers should be afterwards well washed in clean water, and dried upon nets; the meshes of which should be about the fineness of those of cabbage-nets.

The feathers must, from time to time, be shaken upon the nets: and, as they dry, they will fall through the meshes; and are to be collected, in order to be beaten, as usual, for use.

The admission of air will be serviceable in the drying; and the whole process will be completed in about three weeks.

To test the value of the foregoing process, several samples of feathers were furnished to Mrs. Richardson, all of which were returned perfectly cleansed from their animal oil; one parcel had been stoved for three days, but still retained their unpleasant smell, which was completely removed by the lime-water.

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After the Feathers have been cleansed and dried, they are put into a strong bag, like a bed tick, which is laid upon a stage, and beaten with long poles, like broom-handles, until the feathers are perfectly light and lively. [*Editor.*

On Browning Copper Medals, Vessels, &c. *By* T. Gill.

This operation is effected, either by means of Venetian-red or Purple-brown, both being oxides of iron; if, however, the colour of either separately, is not as wished, the two may be mixed together, to produce the desired tint.

The surface of the copper to be browned being well cleaned, the powder is to be mixed with water, to the consistence of cream, and applied, with a soft brush or hair pencil, all over the surface of the article: it is then to be heated, over a charcoal fire, to a sufficient degree to fix the oxide upon the copper. When cold, the superfluous powder must be brushed off; and the medals may then be struck, the vessels hammered, &c.; or, if the articles are to be finished without any other operation, brushing them with a bristle-brush will be sufficient.

Some workmen hold the copper, coated with the oxide, over the smoke produced by putting a little piece of mineral coal into the charcoal fire; and when the stain produced by the smoke upon the copper begins to disappear, they judge it to be hot enough. The great difficulty seems to be in hitting the proper degree of heat; for if it be too great, or too small, the operation will fail, the copper must be re-cleaned, and the process repeated: a little experience will however soon enable the workman to determine the exact temperature.

On Etching and Cleaning Alabaster. By Mr. HENRY MOORE.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

Green Hill, Derby, March 16, 1824.

Sir—I send you an alabaster vase, ornamented by a process which I discovered some time ago; and by which process, soiled alabaster sculptures may also be completely cleaned, and rendered equal to new. I beg you to lay the article before the Society for the encouragement of Arts, Manufactures and Commerce, together with the annexed account of the process by which the ornament is effected.

I am, sir, &c. &c. &c.

HENRY MOORE.

A. AIKIN, *Esq. Secretary, &c. &c.*

Taking advantage of the well known fact that gypsum, or alabaster, or sulphate of lime, (for these are only three names for the same thing,) is perfectly soluble in 500 parts of cold water, Mr. Moore has adopted the following process.

He covers the ornament, and all those parts that are not to be corroded, with a composition that will resist water. Wax, dissolved in spirits of turpentine, and mixed with white lead, may be used with a camel hair pencil; or turpentine varnish, with a little animal oil and white lead; this will be found to work more freely than the wax. Spirits of turpentine must be used in pencilling with these compositions. The use of animal oil, is to prevent the varnish from becoming very hard, which would render its removal, after corrosion, extremely difficult. The ornament, and other parts which are intended to be preserved, being completely covered with the composition, it is suffered to remain a few hours, to dry. The article is then put into a vessel of rain water, in which it must remain 48 hours, or longer, according as the ornament may be required to have more or less relief. When the corrosion is completed, the varnish or wax must be removed with spirits of turpentine, which may be applied with a bit of sponge, and then be wiped off with soft rags.

The article, being made quite clean, is now rubbed over with a soft brush, dipped in finely powdered plaster of Paris, which is applied in the dry state. This powder fills the pores of the corroded parts, giving a certain degree of opacity, similar to that which is left from the tools of the sculptor. It forms a good ground that contrasts well with the ornament, and makes it appear with greater advantage than if left merely in the corroded state.

The alabaster of which the vase is made, was procured from a quarry at Chellaston, about four miles from Derby.

To clean Alabaster Sculptures.

Spots of grease are first to be removed with spirits of turpentine; the article is then immersed in water, where it is suffered to remain about ten minutes, or, perhaps, a little longer, if the thing be very dirty; it is then rubbed over with a painter's brush, suffered to dry, and then treated with plaster of Paris as above, when the article will be found perfectly clean, as if just from the hands of the sculptor.

A piece of sculpture, that would take several days to clean by the usual way, with fish skin and Dutch rushes, is, by this process, completed in half an hour.

On the superior advantages of employing a soft and gentle blast from the Bellows of Smith's Forges, in certain cases, over the sharp blast produced in the ordinary manner of employing them. *By* DUNCAN CAMPBELL, *Esq.*

Mr. CAMPBELL is enabled by this improvement, to perform many of the most delicate and difficult operations in smithery, and particularly *to weld two pieces of tolerably hard cast steel together*, a thing held to be scarcely possible.

He employs a small pair of smith's bellows, viz. only eighteen inches in breadth, and instead of overloading their upper board with weights, as usual, in some cases *he actually removes much of their own weight, by counterbalancing weights.*

In commencing to heat a mass of iron, Mr. Campbell indeed loads his bellows with weights, but, as the mass becomes heated, and especially when it approaches towards a welding heat, he gradually removes them; and, at length, hangs them upon a hook, attached to a line, passing over a pulley, and affixed to the hinder part of the upper board, so as to take off the greater part of its weight. He can thus keep a mass of iron in a continued heat, as long as he pleases, and cause the heat to penetrate to the interior of the mass, without burning away its exterior, or oxyding it by the force of the blast, as usual. We have thus seen him bring a mass of iron, two inches square, and seven or eight inches long, to a welding heat, without the use of sand, to defend its outward parts in the fire; and to continue it in that state for a considerable length of time.

Mr. Campbell also uses a wider aperture to his bellows and tuyere than is usual; his tuyere is an inch in diameter, and widens towards the forge fire, and it thus diffuses the blast more uniformly than in common.

He assures us, and we do not doubt the fact, that he can lay two pieces of cast-steel, properly shaped, under the hammer for welding, as usual, upon each other, in his forge fire; and, by regulating and tempering his blast, cause them to sweat, fuse, and finally unite together, without hammering!

Mr. Campbell so manages his bellows-handle, by a repetition of short and quick strokes, that towards the end of a heat, he does not ever cause the upper hoop of the bellows to rise, and add its weight to increase the force of the blast. It is also his intention to add a gasometer to his bellows, to equalize the blast, and thus avoid those little irregularities, which at present he unavoidably experiences.

We must own, that in all our experience we have never seen the forge fire under such absolute command, and such valuable effects produced from it, as in Mr. Campbell's management.

Mr. Campbell does not approve of the cast-iron forge backs, now in general use; which, although durable, nevertheless rob the fire of a very considerable portion of heat. He prefers to employ bricks set in loam for his forge-back; and the little trouble of occasionally renewing it, is more than compensated by its slow conducting power for heat.

Mr. Campbell is particularly careful in the management of his forge fire, by continually adding wetted small coal, and even occasionally sprinkling water upon its exterior surface, to preserve a good *hollow fire* within it.

We need hardly mention the *great ease* with which *bellows loaded with so little weight* can be worked: and indeed the left hand is fully sufficient to keep the blast up, the right hand being employed in governing the weights, and in attending to the management of the fire, and the article to be heated in it. For *working cast-steel*, in particular, where such great nicety in heating it, is requisite, the *soft fire* thus produced, is most admirably fitted. [*Tech. Rep.*

ON GILDING, SILVERING, AND TINNING.

FROM NICHOLSON'S OPERATIVE MECHANIC.

(Continued from p. 309.)

To Whiten Copper and Brass.—Boil six pounds of cream of tartar, four gallons of water, and eight pounds of grain tin, or tin shavings. After the materials have boiled a sufficient time, the substance to be tinned is put therein, and the boiling continued, when the tin is precipitated in its metallic form. Pins are thus whitened.

To Tin Copper and Iron vessels.—Iron which is to be tinned, must be previously steeped in acid materials, such as sour whey, distillers' wash, &c.; then scoured and dipped in melted tin, having been first rubbed over with a solution of sal ammoniac. The surface of the tin is prevented from calcining, by covering it with a coat of fat. Copper vessels must be well cleansed; and then a sufficient quantity of tin with sal ammoniac is put therein, and brought into fusion, and the copper vessel moved about. A little rosin is sometimes added. The sal ammoniac prevents the copper from scaling, and causes the tin to be fixed, wherever it touches. Lately, zinc has been proposed for lining vessels, instead of tin, to avoid the ill consequences which have been unjustly apprehended.

To prepare the Silver Tree.—Pour into a glass globe or decanter, 4 drachms of nitrate of silver, dissolved in a pound or more of distilled water, and lay the vessel on the chimney piece, or in some place where it may not be disturbed. Now pour in 4 drachms of mercury. In a short time, the silver will be precipitated in the most beautiful arborescent form, resembling real vegetation. This has been generally termed the Arbor Dianæ.

To prepare the Tin Tree.—Into the same, or a vessel similar to that used in the last experiment, pour distilled water as before, and put in 3 drachms of muriate of tin, adding 10 drops of nitric acid, and shake the vessel until the salt be completely dissolved. Replace the zinc (which must be cleared from the effects of the former experiment,) as before, and set the whole aside to precipitate without disturbance. In a few hours, the effect will be similar to the last, only that the tree of tin, will have more lustre. In these experiments, it is surprising to observe the laminæ shoot out, as it were, from nothing; but this phenomenon seems to proceed from a galvanic action of the metals and the water.

To prepare the Lead Tree.—Put ½ an ounce of the super-acetate of lead, in powder, into a clear glass, globe, or wine decanter, filled to the bottom of the neck with distilled water, add 10 drops of nitric acid, and shake the mixture well. Prepare a rod of zinc, with a hammer and file, so that it may be a quarter of an inch thick, and 1 inch long; at the same time, form notches in each side. for a thread, by which it is to be suspended; and tie the thread so that the knot shall be uppermost, when the metal hangs quite perpendicular. When it is tied, pass the two ends of the thread through a perforation in the cork, and let them be again tied over a small splinter of wood, which may pass between them and the cork. When the string is tied, let the length between the cork and the zinc be such that the precipitant (the zinc) may be at equal distances from the side, bottom, and top, of the vessel, when immersed in it. When all things are thus prepared, place the vessel in a place where it may not be disturbed, and introduce the zinc, at the same time fitting in the cork. The metal will very soon be covered with the lead, which it precipitates from the solution, and this will continue to take place, until the whole be precipitated upon the zinc, which will assume the form of a tree or bush, whose leaves and branches are laminal, or plates of a metallic lustre.

Metallic Watering, or Blanc Moiré.—This article, of Parisian invention, which is much employed to cover ornamental cabinet work, dressing-boxes, telescopes, opera glasses, &c. &c. is prepared in the following manner.

Sulphuric acid, is to be diluted with, from seven to nine parts, of water; then dip a sponge or rag into it, and wash with it the surface of a sheet of tin. This will speedily exhibit an appearance of crystallization, which is the moiré.

This effect, however, cannot be easily produced upon every sort of sheet tin, for if the sheet has been much hardened by hammering or rolling, then the moiré cannot be effected until the sheet has been heated, so as to produce an incipient fusion on the surface, after which the acid will act upon it, and produce the moiré. Almost any acid will do as well as the sulphuric, and it is said, that the citric acid, dissolved in a sufficient quantity of water, answers better than any other.

The moiré may be much improved by employing the blow-pipe, to form small and beautiful specks on the surface of the tin, previous to the application of the acid.

When the moiré has been formed, the plate is to be varnished and polished, the varnish being tinted with any glazing colour; and thus the red, green, yellow, and pearl coloured moirés are manufactured.

Chinese Sheet Lead.—The operation is carried on by two men; one is seated on the floor with a large flat stone before him, and with a moveable flat stone-stand, at his side. His fellow workman stands beside him, with a crucible filled with melted lead; and having poured a certain quantity upon the stone, the other lifts the moveable stone, and dashing it on the fluid lead, presses it out into a flat and thin plate, which he instantly removes from the stone. A second quantity of lead is poured in a similar manner, and a similar plate formed, the process being carried on with singular rapidity. The rough edges of the plates are then cut off, and they are soldered together for use.

Mr. Waddell has applied this method, with great success, to the formation of thin plates of zinc, for galvanic purposes.

To plate Looking-Glasses.—This art is erroneously termed silvering, for, as will be presently seen, there is not a particle of silver present in the whole composition.

On tin-foil, fitly deposed on a flat table, mercury is to be poured, and gently rubbed with a hare's foot; it soon unites itself with the tin, which then becomes very splendid, or, as the workmen say, is *quickened.* A plate of glass is then cautiously to be slid upon the tin-leaf, in such a manner as to sweep off the redundant mercury, which is not incorporated with the tin; lead weights are then to be placed on the glass, and, in a little time, the quicksilvered tin-foil adheres so firmly to the glass, that the weights may be removed without any danger of its falling off. The glass thus coated, is a common looking-glass. About two ounces of mercury are sufficient for covering three square feet of glass.

The success of this operation depends much on the cleanness of the glass; the least dirt or dust on its surface, will prevent the adhesion of the amalgam or alloy.

Liquid Foil for silvering Glass Globes.—No. 1.

1 oz. clean lead,
1 oz. fine tin,
1 oz. bismuth, and
10 oz. quicksilver.

The lead and tin must be put into the ladle first, and so soon as melted, the bismuth must be added. Skim off the dross, remove the ladle from the fire, and before it sets, add the quicksilver: stir the whole carefully together, taking care not to breathe over it, as the fumes of the mercury are very pernicious. Pour this through an earthen pipe, into the glass globe, which turn repeatedly round.

No. 2.——2 parts mercury,
1 part tin,
1 part lead, and
1 part bismuth.

No. 3.——4 oz. quicksilver, and
tin-foil.

The quantity of tin-foil to be added, is so much as will become barely fluid when mixed. Let the globe be clean and warm, and inject the quicksilver by means of a pipe at the aperture, turning it about, till it is silvered all over. Let the remainder run out, and hang the globe up.

New Patents for Inventions and Improvements, issued in the United States, from April 12th, to May 9th, 1826.

Improvements in the rocking washing machine, April 12, John G. Philip, Kinderhook, New York.

In the method of cutting mortices, April 12, Thomas Green, Manlius, New York.

In the pump, April 13, Theodore Brooks, Rutland, New York.

In the tooth of the cultivator, or harrow, April 13, Waldren Beach, Philadelphia.

In the loom for weaving carpeting, April 14, Horace Baker, New York.

In the mode of raising vessels for repairing, April 15, Benj. Waterhouse, N. York.

In distilling spirits from cider and grain, April 15, Samuel Harwood, 3d, Braintree, New York.

In the horse mill, April 15, Admiral Warren, Saugerties, New York.

In the boring and tenoning machine, April 17, Admiral Warren, Saugerties, New York.

In the grist mill, April 18, Moody Stockman, Hampton, New Hampshire.

In the cast iron plough, April 19, Thaddeus Fairbanks, Johnsbury, Vermont.

A conical water wheel, April 19, Boswell Wilcox, Franklin county, Ohio.

In the loom, April 21, Boswell Wilcox, Franklin county, Ohio.

In the vertical saw, for making fret work, April 22, Ebenezer Booth, Southbury, Connecticut.

In the machine for splicing cotton and woollen rolls, April 22, Gardner Barton, Jr. Shaftsbury, Vermont.

In the varnish for furniture, &c. April 22, Marcus Curtis, Troy, New York.

In the mode of picking oakum by machinery, April 24, Ezekiel Waterhouse, Gardiner, Maine.

In the geer for mills, &c. April 24, Charles Wortham, Warren county, North Carolina.

In constructing tan vats, April 24, Aaron Higgins, Florence, Ohio.

In the machine for cleaning grain, of rat dung, &c. April 25, Lemuel Lee and Cornelius Masten, Penn-Yan, Yates County, New York.

In the elevating screw box and cap, of carronades, &c. April 26, Enoch Hidden, New York.

In the machinery for steering vessels, April 26, Stephen G. Clark and Geo. Stimpson, Charleston, Mass.

In the construction of rail roads, April 27, Henry Pinkus and Thos. R. Williams, London, England.

In steam boats for navigating shallow water, April 28, Benjamin Phillips, N. York.

In the plough, April 28, William Cock, Luzerne Township, Pennsylvania.

In the horizontal spinner, May 2, Bemsle Hunt and Seth Wheelock, Knox, New York.

In the machine for pressing bricks, May 2, Julius Willerd, Baltimore.

In the vertical jenny for spinning wool, &c. May 2, James Matthews, Schenectady, New York.

In making artificial globes, May 4, William B. Annin, Boston.

In the inclined horse wheel, May 5, Elias Holliday, Schoharie, New York.

In the machine for moulding brick, May 6, David Watson, Fayetteville, Maine.

In the rail way, May 6, Ethan Baldwin, Harrisburgh, Pennsylvania.

In the machine for thrashing grain, May 9, John Shaw, Kennebec County, Maine.

In the machine for relieving water wheels, May 9, Jare Benedict, Fabius, New York.

In covering or platting brick kilns, May 9, Samuel R. Bakewell, Wellsburg, Virginia.

List of New Patents in England, which have passed the Great Seal, since Feb. 25, 1826.

James Fraser, Houndsditch, London, engineer, for an improved method of constructing capstans and windlasses. Dated February 25, 1826.

Benjamin Newmarch, Cheltenham, Gentleman, for certain inventions to preserve vessels and other bodies from the dangerous effects of external or internal violence on land or water, and other improvements connected with the same. Dated February 25, 1826.

The same, for a preparation to be used either in solution or otherwise, for preventing decay in timber or other substances, arising from dry rot or other causes. Dated February 25, 1826.

James Fraser, Houndsditch, London, engineer, for a new and improved method of distilling and rectifying spirits and strong waters. Dated March 4, 1826.

Robert Midgley, Horsforth, near Leeds, Gent. for a method, machinery, or apparatus, for conveying persons and goods over or across rivers or other waters, and over vallies or other places. Dated March 4, 1826.

George Anderton, Chickheaton, Yorkshire, worsted spinner, for improvements in the combing or dressing of wool and waste silk. Dated March 4, 1826.

James Neville, New Walk, Shad Thames, engineer, for a new and improved boiler or apparatus for generating steam with less expenditure of fuel. Dated March 14, 1826.

Nicholas Hogesippe Manicler, of Great Guildford street, Southwark. chemist, for a new preparation of fatty substances, and the application thereof to the purposes of affording light. Dated March 20, 1826.

TO SUBSCRIBERS.

The subscription for the year, is now due; those who are in arrears, are requested to pay the amount at an early day. New subscribers will be expected to pay in the course of the year. The numbers will not be sent a second year, to those who have not paid for the first.

THE
FRANKLIN JOURNAL,
AND
AMERICAN MECHANICS' MAGAZINE;
DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS, AND GENERAL SCIENCE.

AUGUST, 1826.

ON ENGRAVING.

(From the Mechanic's Gallery, By C. F. Partington.)

(Continued from p. 12.)

On Etching.

In etching, the strokes and dots on the copper-plate, instead of being cut with a tool, are corroded by an acid, by which means the effect of engraving is produced, with great expedition. To perform it, the plate is covered with a thin coat of a resinous substance, upon which the acid employed, has no action; the design, and all the lines it requires, are next traced with a steel point, so as just to cut through the resinous substance; an acid is then poured upon the plate, and allowed to remain on it, till it has corroded the metal to a sufficient depth, in all the places where the tracing has been made.

The resinous composition which is laid upon the plate, is called the *ground;* and the instruments which are used to make the requisite lines upon it, are called *etching needles.* A dry point may in fact be used as an etching needle, and *vice versa,* and the manner of whetting both is the same; but etching needles are required of several thicknesses. They generally consist of pieces of steel wire, about two inches in length, inserted into cylindrical handles of hard wood, about five inches long, and the third of an inch, in diameter. The steel tapers gradually towards the point, except a small portion of the extremity, which is made conical. They are whetted in a small groove made at one end of the oil-stone.

A great variety of compositions have been recommended for etching grounds, and almost every artist has some peculiarity in the mode of preparing the one he uses; but the general nature of the ingredients is in all the same. There are three kinds of grounds in use, the hard, the common, and the soft; and for each kind, the following recipes may be considered as of the best authority.

For a soft ground, take one ounce of white, or bleached bees' wax, one ounce of asphaltum, half an ounce of common pitch, and half an ounce of Burgundy pitch. Melt the wax over a slow fire, in a pot of glazed earthenware; add to it the rest of the ingredients by little and little, stirring the mixture all the time it is on the fire. The asphaltum should be pounded in a mortar before it is put in. Care must be taken to prevent its burning, by using a low heat. When the whole is thoroughly melted and incorporated, take it off the fire, throw the whole mass into a vessel of clean warm water, and knead it with the hands, into balls about the size of walnuts, or a little larger.

In summer, the ground should be made rather harder than in winter, by increasing the quantity of asphaltum, or continuing the boiling for some time after the incorporation of the ingredients.

For a common ground, the composition is a medium between the hard, and the soft ground, and is the most extensively used. Lowry, whose merit and success as an artist, have never been excelled, is said to form it with three parts of asphaltum, two of Burgundy pitch, and one and a half of white wax. The asphaltum must be powdered and melted first, and the other ingredients being added as soon as it is in a state of fusion, are thoroughly mixed with it; the whole is then poured out into warm water, and kneaded into balls.

This is an excellent composition: it is adapted to temperate weather: in very cold weather, the proportion of pitch may be a little increased; for very hot weather, it may be hardened by boiling it rather longer, than would otherwise be necessary. If in kneading the etching ground, any part of it should adhere to the hand, it may be entirely removed by a little fresh butter, having first rubbed off the principal part with a towel, after warming the hands at the fire.

For a hard ground, take four ounces of fat oil, very clear, and made of good linseed oil, like that used by painters. Heat it in a clean earthen pipkin, add to it four ounces of powdered gum mastic, and stir the mixture briskly, till the whole be well combined. Then press the whole mass through a piece of fine linen into water, and form it into balls, like the grounds above described. This is the hard varnish used by Callot, and is called the Florence varnish. It answers perfectly well.

The copper-plate for etching, is prepared in the same manner as for engraving with the tool, and it should be cleansed from greasiness by rubbing it with a clean cloth, and Spanish white. To cover it with the ground, it must be heated, as for example, in a common kitchen oven, or by holding it over a chafing dish of burning charcoal. When it is hot enough, a ball of the ground to be used, should be in readiness, tied up in a piece of tiffany, and should be dabbed all over the heated plate, till a sufficient quantity of it is melted, to form a thin coat. That there may be no bubbles, or want of continuity in the ground, which would be fatal to success in the subsequent operations, the ground should be dabbed and united, with a ball of cloth, till it begins to stiffen; and the ground must never be heated so much as to smoke. The next operation is to blacken the varnish, which is done by holding the surface covered with it, over the flame of one or more candles, according to the size of the plate, and moving it about, till every part has been blackened by the smoke. The plate should never touch the snuff of the candle, and as soon as the blackening is complete, it must be left to cool in a place where it will not receive the least dust. The blackness of the ground, renders every stroke made with the needle distinct, from the brightness of the copper, which immediately appears.

To transfer the design to the ground, it must be traced upon transparent paper, as for engraving with the tool, except that a pen and Indian Ink should be employed, instead of a pencil; this ink will easily mark the transparent paper, if mixed with a little ox-gall; another thin piece of paper must then be smeared with red chalk, which should be rubbed on, till it covers the paper equally, and will not easily come off; the chalked side of this paper must be placed flat upon the ground on the plate, and the traced side of the transparent paper must be placed next to it, and both secured from moving, by pieces of wax at the corners. In the distinctness of the design on the transparent paper, there will scarcely be any difference of the sides; and therefore all the lines may be gone over with a blunted steel, or ivory point. On lifting up the papers, a distinct outline will be found upon the ground, in consequence of the red chalk adhering to it, wherever it received the pressure of the point. And as the back of the transparent paper has been traced upon, the design on the ground will be reversed, with respect to right and left, so that the impression of the plate will resemble the original: but if the contrary be desired, it is only necessary to trace upon the right side of the transparent paper. The etching needle must now be used, and lines to form the outlines, and shades, must be traced with it, either by hand, or with the assistance of compasses and parallel ruler, as the case requires; taking care to use different needles according to the fineness, or strength, of the strokes required.

Oval-pointed needles are the most proper for strong strokes. The needles should be held as nearly upright as possible.

The varnish raised by the needle should be removed from the plate frequently, to prevent its stopping up the lines in any part. The whole design being completed, the plate is ready for biting.

Previous to the use of the acid, the plate should be examined, and if any improper strokes have been made, or if the ground be any where broken up, a composition, called the stopping mixture, must be immediately applied to it. This is formed of turpentine-varnish, and lamp-black. It may be applied to the ground, with a brush, or a pencil, and will, when dry, answer the same purpose as the original ground, either for tracing upon with the needle, or wholly to resist the acid.

The design being complete, the plate is surrounded with a border or wall, about an inch high, composed of bees' wax, softened by the addition of one-third of Burgundy pitch, or tallow. The common nitric acid of the chemists, diluted with an equal quantity of water, is now poured upon the plate, to the depth of about half an inch. The acid will speedily begin to act upon the copper, where it has been laid bare by the strokes of the needle, and bubbles will immediately rise to the surface. These must be immediately cleared away with a feather as fast as they appear, and also such as are observed to adhere in the strokes.

When the faintest parts of the design, are supposed to be sufficiently bitten, the nitric acid is poured off, by a spout left for that purpose at one corner of the border, and only slightly stopped with a separate piece of wax. The plate is washed with water, and all the parts supposed to be sufficiently bitten, are, when dry, covered with the stopping mixture already mentioned. The spout is now filled up, the acid poured on again, and the same operation repeated, till all the shades are sufficiently bitten. The plate, after being washed, is then heated, and some olive oil being poured upon it, the ground is wholly removed with a linen rag, and the plate made clean with the oil-rubber. The dirt which remains in the lines, may be washed out with spirits of turpentine.

No precise direction can be given for the length of time which the acid must remain upon the plate, and the real depth of the biting cannot be known, by examining a plate while the varnish is on it. From half an hour, to an hour, is the usual time for fine work, but a day and even several days is required for some designs. The effect must therefore be ascertained by scraping off a small part of the ground, to examine the plate; or by using a spare piece of plate, upon which a ground is laid, and lines drawn similar to those on the true plate, and trying what time the acid to be used requires, for producing the effect desired. It is, however, to be observed, that the same acid will have different effects on the same copper, in seasons of different temperature, its power being weakened by cold; and even so slight a circumstance as that of the sky becoming overcast, and gloomy, during the operation of biting, will retard the action of the acid.

When the ground is entirely cleared away, and any part is observed to be over-bitten, it may be corrected by rubbing it with the burnisher, if it be slight; but if the excess of biting be considerable, the copper must be rubbed down with charcoal.

When any part of the plate is materially too faint, it may be rebitten, but this is a very delicate and hazardous operation. A little of the etching ground being melted on a spare piece of copper, it may be taken up by the dabber, and dabbed upon the part to be rebitten, in such a manner that it may not enter the former strokes, but merely adhere to the uncut part of the copper. The part is then surrounded with wax, and the acid used in the customary manner. The strokes to be rebitten, must be entirely cleansed from any foulness, by the use of spirits of turpentine, and afterwards rubbing it with the crumb of bread.

The art of etching, in its infancy was considered as a spurious kind of engraving, and those who adopted it, from the facility with which it was performed, were anxious to conceal their use of it, and to give their work as much as possible, the appearance of having been executed with the graver. Hence they used the hard ground or varnish, as it produced the sharpest lines, and was best adapted to their purpose. But when the peculiar excellences of the two arts, was ascertained, etching was better appreciated, and this concealment was no longer necessary; and therefore the common ground, for general use, has entirely superseded the hard ground, because it admits of so much more freedom in the use of the needle.

Etching, is peculiarly adapted to the expression of all objects which are termed picturesque, such as ancient buildings, cottages, rocks, uneven ground, trees, and verdure in general. This arises from the freedom with which the lines forming these objects may be drawn with the needle, which may be used in the same manner as a black-lead pencil, and also from a certain agreeable roughness left in the strokes when the acid is allowed to bite freely. But etching has also the apparently opposite property, of being well adapted to smooth flat surfaces, of every description. This arises from the uniform action of the acid, in biting the strokes in every part alike, a property in which it can never be rivalled by the graver.

It has been mentioned, that plates, professed to be done with the tool, are scarcely ever executed without some assistance from etching; it may be added, that the copper-plates professed to be etched, are scarcely ever committed to the press, without some touches of the graver, and dry-point. The two arts mutually and essentially assist each other.

(TO BE CONTINUED.)

On the Nature and Properties of Timber, extracted from "The Elementary Principles of Carpentry. By THOMAS TREDGOLD."

(Continued from p. 50.)

ON SEASONING TIMBER.

When timber is felled, the sooner it is removed from the forest, the better: it should be removed to a dry situation, and placed so that the air may circulate freely round each piece, but it should not be exposed to the sun and wind. Squared timber, does not rift, or split, so much as that which is round; and where the size of the trees will allow of it, it is better to quarter them. When beams are to be used the full size of the tree, it would be a good preservative against splitting, to bore them through from end to end, as is done in a water-pipe. It is irregular drying, that causes timber to split, and this method would assist in drying the internal part of the beam, without losing much of its strength; at the same time, it would lighten it considerably.

Duhamel has shown that it is a great advantage to set the timber upright, with the lower end raised a little from the ground; but as this cannot always be done, the timber yards should be well drained, and kept as dry as possible. Paved yards are to be preferred, and the paving should have a considerable fall, to prevent water standing. If the paving were laid with ashes, it would be better; those from a forge or foundry, would be excellent; even an unpaved yard would be improved by a coat of ashes, to prevent any thing growing among the timber.

If timber can be kept some time in a dry situation, before it be cut into scantlings, it is less subject to warp, and twist, in drying; but during the time it is kept in the tree or log, it should be carefully piled, so as to leave space for a free circulation of air between each piece, and also between the timbers, and paving, or ground. Lately, in some of the government yards, the timber has been laid upon cast-iron bearers, instead of being laid upon refuse pieces of wood; as the refuse wood is often half rotten, and must in some degree contribute to infect the sound timber. Timber is too often suffered to lie half buried in the ground, or grown over with weeds, till it be covered with fungus, and impregnated with the seeds of decay before it be brought into use.

When it shall have become convenient to convert the timber into smaller scantlings, it still requires attention; as the better it is seasoned, when brought into work, the better the work will stand, as well as be more durable. The experiments of Duhamel, show, that such scantlings will dry soonest in an upright position, and that the upper end, dries more rapidly than the lower one. But whether the pieces of timber be piled on the end, or laid horizontally, a free space should be left round each piece, and the situation should be dry, and airy, yet not exposed to the direct rays of the sun. If the scantlings be laid horizontally, short blocks should be put between them; which will preserve them from becoming mouldy, and will contribute much towards rendering the sappy parts, more durable.

Gradual drying, where the time can be allowed for it, is the most certain means of giving durability to timber, by fixing those parts of it, which are most liable to be acted upon, by heat, and moisture.

It is well known to chemists, that slow drying will render many bodies less easy to dissolve, while rapid drying on the contrary, renders the same bodies more soluble; besides, all wood in drying loses a portion of its carbon, and the more, in proportion as the temperature is higher. There is, in wood that has been properly seasoned, a toughness and elasticity which is not to be found in rapidly dried wood. This is an evident proof that some essential parts are dissipated in a high heat. Also, a forced seasoning, produces a hard crust on the surface, which will scarcely permit the moisture to evaporate from the internal part, and is very injurious to the wood.

For the general purposes of carpentry, timber should not be used in less than two years after it is felled; and this is the least time that ought to be allowed for seasoning. For joiner's work, it requires four years, unless other methods be used; but for carpentry, natural seasoning should have the preference.

Duhamel says, that the quantity of matter which ought to be evaporated from green oak, is about one-third, or two-fifths of its weight; the proportion, however, will vary according to the age, and quality of the timber, and the nature of the soil that produced it. I shall attempt to establish the relation between the size of the pieces, and the time necessary to season them, in a succeeding article, as it is a subject that has not received that share of attention, which its importance merits.

Water Seasoning.—On account of the time that it requires to season timber in the natural way, various methods have been tried to effect the same purpose in a shorter time. Perhaps the best of these is, to immerse the timber in water, as soon as it is cut down; and after it has remained about a fortnight in water, but not more, to take it out, and dry it in an airy situation.

Evelyn directs, to lay your boards a fortnight in water (if running, the better, as at a mill-pond head) and then setting them upright, in the sun and wind, so as it may pass freely through them, turn them daily; and, thus treated, even newly-sawn boards, will floor far better than those of a many years dry seasoning, as they call it;" and he adds, "I the oftener insist on this water seasoning, not only as a remedy against the worm, but for its efficacy against warping and distortions of timber, whether used within, or exposed to the air."

Duhamel, who made many experiments on this important subject, states, that timber for the joiner's use, is best put in water for some time, and afterwards dried; as it renders the timber less liable to warp, and crack in drying; but, he adds, "where strength is required, it ought not to be put in water." And he found, from numerous experiments, that timber which had remained some time in fresh water, lost more of its weight in drying, than that which was dried under cover; and he observed, that green timber that had been steeped in water for some time, was always covered with a gelatinous substance.

Timber that has been cut when the tree was full of sap, and particularly when that sap is of a saccharine nature, must be materially benefitted by steeping in water; because it will undoubtedly remove the greater part of the fermentible matter. Duhamel has ascertained that the sap-wood of oak, is materially improved by it, being much less subject to worm-eat; and also, that the tender woods, such as alder and the like, are less subject to the worm, when water seasoned. Beech is said to be much benefitted by immersion; and green elm, says Evelyn, if plunged four or five days in water (especially salt-water) obtains an admirable seasoning.

When timber is put in water, it must be sunk so as to be completely under water, as nothing is more destructive than partial immersion. Salt water is considered best for ship-timber, but for timber to be employed in the construction of dwelling-houses, fresh water is better.

Of Steaming and Boiling Timber.—Though steaming, or boiling, impairs the strength and elasticity of timber, it gives another property, which for some purposes, is still more desirable than strength; for boiled, or steamed timber, shrinks less, and stands better, than that which is naturally seasoned. Therefore it may often be useful to season timber in this manner, where joiner's work is to be executed in oak of British growth, as without this precaution, it requires a long time to season it, so as to be fit for such purposes.

The timber should not remain long in boiling water, or steam; four hours will, in general, be quite sufficient: and after boiling or steaming, the drying goes on very rapidly, but it is well not to hasten the drying too much. Steamed wood, dries sooner than that which is boiled, according to Mr. Hookey's experiments.

How far steaming, or boiling, affects the durability of timber, has not been satisfactorily ascertained; but it is said, that the planks of a ship, near the bows, which are bent by steaming, have never been observed to be affected with the dry rot. The changes produced by boiling, as observed by Duhamel, are not very favourable to the opinion, that it adds to the durability of timber. For when a piece of dry wood was immersed in boiling water, and afterwards dried in a stove, it not only lost the water it had imbibed, but also a part of its substance; and when the experiment was repeated with the same piece of wood, it lost more of its substance the second time, than it did the first. The same thing takes place in green wood; and tender woods, or those of a middling quality, are more altered by these operations, than hard woods, or those of a good quality. Dr. Watson found steeping long in cold water, produced similar effects; and that box, oak, and ash, lost more weight by this process, than mahogany, walnut or deal.

Of Smoke-drying, Scorching and Charring Timber.—It is an old, and a well founded observation, that smoke drying, contributes much to the hardness and durability of wood. Virgil seems to have been aware of its utility, when he wrote the passage which is thus translated by Dryden:

> " Of beech, the plough-tail and the bending yoke,
> Or softer linden *hardened in the smoke.*"* *Georgics*, I. 225.

But this method can only be effectually applied on a very small scale; yet sometimes, for particular purposes, it may be useful to season in the smoke. As a substitute for the smoke of an open chimney, Ellis advises to burn fern, furze, straw, or shavings under the timber, which would destroy any seeds of fungi or worms, and so embitter the external surface as to prevent any future ill effect from either. It would be easy to contrive the means of smoke-drying, for the use of a manufactory, where much seasoned wood was used.

Scorching must do timber much harm when it is done hastily, so as to cause rents and cracks in it; as these become receptacles for moisture, and consequently must be the cause of rapid decay.

It must be always remembered, that charring the surface is only useful in as far as it destroys and prevents infection; and that it should be applied only to timber already seasoned; for when it is applied to green timber, it only closes up the pores at the surface, so that the internal sap and moisture cannot evaporate.

In that kind of decay which arises from the constant evaporation of moisture, charring the surface produces no effect. Duhamel made some experiments on this point, and found that there was very little difference between the posts he had charred, and those he had not charred, at the end of six years; but as a preventive of infection by the dry rot, and of the worm in timber, charring appears to be very beneficial, and will no doubt be assisted by impregnating the timber with the bitter particles of smoke.

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* Beckman (in his history of inventions, vol. 2. p. 77) quotes a passage from Hesiod to the same effect; and adds, "as the houses of the ancients were so smoky, it may be easily comprehended how, by means of smoke, they could dry and harden pieces of timber." In this manner were prepared the pieces of wood destined for ploughs, wagons, and the rudders of vessels:

> " These long suspend, where *smoke* their strength explores,
> And seasons into use, and binds their pores." *Sotheby's Virgil.*

Tables of the weight of Timber in different States.

As a suitable introduction to some remarks on seasoning, I subjoin the following tables.

Weight of a cubic foot of Timber, Green, and also its weight a year afterwards.

From Duhamel's experiments; reduced to English Weights and Measures.

Kind of Wood.	Weight of a cubic foot green	Weight of a cubic foot one year afterwards.
Oak of Provence	78.25	68.3
Elm, ditto	57.14	47.5
Poplar, ditto	49.68	30.69
Walnut, ditto	54.43	44.08
Lime, ditto	45.2	27.96
Beech of Bourgogne	56.25	43.95
White pine of Provence	53.73	43.93
Norway pine, dry		36.75

The writer of an article on Timber, in the Encyclopedie Methodique, states that the weight of a cubic foot of green oak varies from 62.5 to 66 pounds; of a cubic foot of seasoned oak, from 53.5 to 58 pounds; and a cubic foot of very dry oak, from 44.6 to 47.3 pounds. The timber of very old trees is often much lighter than this; I have tried specimens from old trees that did not exceed 38.5 pounds per cubic foot when dry. When the specific gravity is very low it may be safely concluded that it is the wood of an old tree, and that it will be brittle, and deficient both in strength and toughness.

Some experiments have been made on the loss of weight in seasoning by Mr. Couch, at the Royal Dock Yard, at Plymouth, from which the following are taken.

Kind of Wood.	Weight when felled of a cubic foot.	Weight seasoned of a cubic foot.	Shrinkage in seasoning.
	pounds.	pounds.	
Oak (butt end)	69	$47\frac{1}{2}$	$\frac{1}{32}$
Elm	$58\frac{1}{2}$	$36\frac{1}{2}$	$\frac{1}{44}$
	Weight of a cubic foot when first imported.		
Riga masts	42	40	$\frac{1}{72}$
Pitch pine, American	47	$46\frac{1}{4}$	$\frac{1}{40}$
Yellow pine, ditto	$42\frac{1}{2}$	$28\frac{3}{4}$	$\frac{1}{144}$
Spruce pine, ditto	33	$32\frac{3}{4}$	$\frac{1}{112}$

To these experiments the following new ones are added, which include some varieties of wood not before tried.

Kind of Wood.	Weight of a cubic foot when green.	Weight of a cubic foot dry.
	pounds.	pounds.
Oak sap-wood (quercus sessiliflora)	67.0	47.07
Spanish Chesnut	54.68	37.91
Larch	42.06	30.99
Walnut	57.5	38.5
Acacia (robinia pseudo-acacia)	51.25	46.76

We are also indebted to Mr. Wiebeking for some experiments on seasoning timber; and as both the kinds of timber and the times of observation are different from those already noticed, his table is a considerable addition to our knowledge of this important subject. It is, in common with all the other tables in this work, reduced to English weights and measures.

Weight of a cubic foot of wood in different states.

Kind of Wood.	Weight of a cubic foot fifteen days after the wood was felled.	Weight of a cubic foot after 3 months' exposure to the air.	Weight of a cubic foot when dry.
	pounds.	pounds.	pounds.
Oak	58.74	56.18	39.27 to 39.58
Larch	53.63	51.08	38.31
Pine (pinus sylvestris)	51.08	38.31	26.817
Pinaster	52.35	33.2	25.54
Fir (pinus picea)	33.2	29.37	25.22 to 25.54

Wood, when it is cut into small pieces, very soon acquires its utmost degree of dryness. Dr. Watson, Bishop of Llandaff, in the month of March, cut a piece from the middle of a large ash tree that had been felled about six weeks, and weighed it; its weight was 317 grains; in seven days it lost 62 grains, or nearly one-fifth of its weight. It was weighed again in August of the same year, but had not lost any more of its weight; hence it had become perfectly dry in the short space of seven days. He also found that the sap-wood of oak lost more weight in drying than the heart-wood, in the proportion of 10 to 7.

Mr. Pontey has ascertained that the sap-wood of larch loses two-fifths of its weight in drying.

(TO BE CONTINUED.)

Practical Observations and results, in the Manufacture of Iron from the ore into blooms, in Shropshire. By ARTHUR AIKIN, *Esq. Secretary to the Society for the encouragement of Arts, Manufactures, and Commerce, &c. &c.*

Society of Arts, &c. &c. Adelphi, Nov. 22, 1825.

Dear Sir,—Perceiving in the *Technical Repository* many interesting practical communications respecting Iron and Steel, the following particulars may, perhaps, not be unacceptable. They are the result of enquiries made by me, some years ago, *under very favourable circumstances*, respecting the practice pursued at a large Iron Smelting Work in Shropshire; and which, at that time, produced some of *the best Iron* in the English market.

I am, Dear Sir, yours,

T. Gill, *Esq.* Arthur Aikin.

Process of Puddling Iron, as practised at the Lightmore Works, in Shropshire.

The different stages of the manufacture, from the ore to the making blooms, are, briefly, the following:—

1. The roasted ore, being mixed with limestone, is reduced in the *high smelting furnaces*, (with coak,) which are *tapped* at regular intervals; and the melted iron runs into furrows, made in sand, and thus forms *pigs*.
2. The pigs, being broken into two or three pieces each, are remelted in the *refinery furnace*, (with coak) and the produce being let out into a shallow, flat, cast-iron trough, forms thick plates, called *slabs*.
3. The slabs being broken, are melted in the *puddling furnace*, (with coal,) and brought out in large masses, called *balls;* which, while yet glowing hot, are;—
4. Laid under a very heavy hammer, and *stamped* into *plates;* which are then thrown into water, in order to cool them.
5. The plates being broken, the pieces are piled one on the other, to the height of about a foot and a half, and placed in a *reverberatory furnace*, called a *balling furnace*; from which, when sufficiently heated, (by coal) they are removed to the *shingling hammer*, where they are beaten into short, thick bars, called *blooms*.

The following are the particulars observed during the process of Puddling.

The furnace employed is a *reverberatory* one, of very simple construction, and the fuel used is coal. The flat area of the furnace being previously covered with sand, the charge was put in, consisting of 3½ *cwt.* of broken slabs, which were heaped up loosely in the middle of the furnace. The door was then carefully closed, and the full force of the flame was let on. In about half an hour the door was opened, and the glowing metal being partly fluid, the workman was engaged in breaking and spreading it for about five minutes, water being thrown on occasionally in small quantities, by a scoop, and being immediately succeeded by much ebullition, and the disengagement of copious jets of white light. The spreading being completed, the door of the furnace was again closed, and the flame turned on for two or three minutes. The door was then opened, the flame turned partly off, and the charge worked by incessant stirring; a few wet scales of iron, and water in small quantities, being occasionally added: the charge now began to grow pasty, and to adhere to the tools. The fire was still further damped, and water, in small portions, was frequently added; the mass being incessantly worked with great vigour: the jets of flame were very copious, and the metal still pasty, and adherent to the tools. The working of the mass was still continued, but without the addition of water; and soon after the metal began to lose its coherence; more water was then added, and the breaking down of the metal proceeded rapidly; it still, however, adhered more or less to the tools, till it was reduced to the consistence of coarse gravel; at this period, the jets of white light were succeeded by a heavy red vapour, indicating the necessity of more heat: the full force of the flame was then let on, the door of the furnace continuing open, and the workman adding water, and stirring the mass incessantly; the jets of white light reappeared, the metal became of the consistence of coarse sand, and began to *come into nature*, i. e. *to clot*. The iron now burned rapidly, with an intense white light, upon which the fire was damped a little; the metal was every minute becoming more cohesive, it was of a glowing white, and burnt away very fast; water, in small quantities, was still added. The metal was now of a pasty consistence, and did not adhere to the tools: *it was come completely into nature;* and was made up into several lumps; one hour and a half being expired, from the first charging the furnace.

The door of the furnace being now closed, the full force of the fire was let on for two or three minutes; after which, the door being opened, and the flame damped, the lumps were *dollyed*, i. e. compressed and beaten with a heavy iron mace; and were made up into five nearly equal balls; one hour and three quarters being now expired.

The balls, glowing hot, were then removed from the furnace to the *stamping hammer*, where they received from 70 to 100 blows each, and were thus formed into rough plates; being then cooled in water, they were weighed, and amounted, in the whole, to two hundred weight, three quarters, and nineteen pounds, or nearly 86 per cent.

The following Answers to Queries addressed by me to the manager of the Works, cannot but prove interesting.

On Roasting the Ore.

Query 1.—How much coal, and of what kind, is employed in roasting the ore, per ton?

Answer.—Five hundred weight. We used small coal from the pits.

Query 2.—How much time does this process require?

Answer.—It may be done in a week, in small quantities; but it is better done, and much cheaper, in large quantities.

Query 3.—What loss of weight does the ore undergo?

Answer.—Nearly one fourth.

On Making Coal into Coak.

Query 4.—What kinds of coal are made into coak?

Answer.—All the kinds, excepting the *stinking coal*, (that abounding in pyrites,) but *top coal* makes the best.

Query 5.—What time does the process require?

Answer.—From five, to seven or eight days.

Query 6.—What is the loss of weight in converting coal into coak?

Answer.—One half.

On the Limestone employed in Smelting.

Query 7.—What are the different varieties of limestone that are employed?

Answer.—The Wenlock and Littleshall.

Query 8.—Why is the Littleshall reckoned the best?

Answer.—Less weight of it, is said to flux more ore; and it comes cheaper than the Wenlock.

On Smelting the Ore.

Query 9.—What are the relative proportions of *Penny-stone* and *Spar-stone*, (the two varieties of iron ore, used at the works?)

Answer.—We mix about one-twelfth of spar-stone with penny-stone.

Query 10.—What proportion of limestone is employed?

Answer.—About ten hundred weight of Littleshall. Rather more, if the Wenlock stone is used.

Query 11.—What proportion of coak is employed?

Answer.—Forty-five hundred weight to a ton of iron, on an average of the different kinds.

Query 12.—The number of runnings, and weight of metal obtained in twenty-four hours?

Answer.—Two runnings, and about seven tons of Iron, if for forge-pigs; not more than six tons, if for melting pigs. This depends upon the size of the furnace.

Query 13.—How much roasted ore is required for a ton of iron?

Answer.—Forty-five hundred weight is the general calculation: but we worked at forty-two hundred weight to a ton.

On Pig Iron.

Query 14.—The names, external characters, and properties of pig iron?

Answer.—*Gray*, *white*, *smooth*, and *honeycomb* pigs. The smooth-surfaced pigs are highly blown, and are used for melting into castings. The honey-combed pigs are used for forge-iron.

Query 15.—On what circumstances do the varieties in pig-iron depend?

Answer.—The smooth surfaced pig-iron, has had more blast in a given time. Farther than this, I cannot say. It would have been a very valuable circumstance to us to have been able to answer this question more satisfactorily.

Query 16.—Does Littleshall limestone afford better iron than Wenlock limestone.

Answer.—I do not imagine that the experiment has ever been made; but I can say, that we have worked for months together, with Wenlock limestone, and have had as good iron, as when the Littleshall was used.

Query 17.—What effect has the temperature, and the dryness or moisture of the air, on the smelting; and on the quantity or quality of produce?

Answer.—In cold and dry weather, we had more and better pig-iron, than when the air was hot and moist. I regret that this question cannot be answered in a better manner.

On Refining the Iron.

Query 18.—Are not the different qualities of pig-iron mixed in certain proportions, in the refining?

Answer.—They are, sometimes; but the refined iron is generally of a better quality, when the pig-iron is all of one sort, viz. with a honey-combed face, and with an open, bright gray fracture.

Query 19.—What is the produce in refined iron *(slabs)* per ton, of pig-iron?

Answer.—Sixteen hundred weight, two quarters, and twelve pounds. The workmen are expected to produce a ton of slabs for every twenty-four hundred weight of pig-iron.

Query 20.—The quantity of coak used for each ton of slabs?

Answer.—Seven hundred weight and two quarters.

Query 21.—The time required for the process?

Answer.—Two hours.

Query 22.—What are the external characters and properties of good slabs?

Answer.—A honey-combed surface, and a bright, silvery, glistening fracture.

On Puddling and Stamping the Iron.

Query 23.—What is the produce of stamped iron per ton, of slabs?

Answer.—Seventeen hundred weight, one quarter, and sixteen pounds. The workmen are expected to produce a ton of stamped iron, for every twenty-three hundred weight of refined iron, or slabs.

Query 24.—How much is required in the preparation of one ton of stamped iron?

Answer.—About twenty-five hundred weight.

On the Blooms.

Query 25.—What is the produce in blooms per ton, of stamped iron?

Answer.—About sixteen hundred weight, three quarters, and ten pounds. This was our average quantity in two years.

Query 26.—How much coal is used in the preparation of one ton of blooms?

Answer.—About twenty-two hundred weight.

Query 27.—What are the external characters and properties of good blooms and bad ones?

Answer.—Good blooms should be of a bright lead colour, and should break wiry and tough. Bad blooms are of a dirty red colour, and break short.

The following is a tabular arrangement of the ingredients and produce of each operation, calculated on one ton of blooms. The numbers express cwts. and their decimal parts.

91.41	raw ore	+	22.85	small coal produce		68.73 roasted ore.
68.73	roasted ore pig iron.	+	147.28	coal, (73.64 coak)	+ 17 limestone	= 32.73
32.73	pig iron refined.	+	20.46	do. (10.23 coak)		= 27.28
27,28	refined iron stamped.	+	2965			= 23.73
23.73	stamped iron blooms.	+	22. 0			= 20.
			242.24			

[*Tech. Rep.*

On the Mineral History of Gold, and on the separation of it from Earthy and Stony bodies by water, Mercury, &c. By the late WILLIAM LEWIS, M. D.

Gold is found in its perfect metallic state, sometimes in masses of considerable magnitude, more frequently in dust or minute grains, intermingled among earths and sands, or in little drops and veins, bedded in different coloured stones, which strike fire with steel, and are not soluble in aqua-fortis. It is never debased into a true ore, as other metals generally are, by the coalition of arsenical or sulphureous bodies; though it is often very intimately combined in the composition of sands and stones, and blended in small proportion, with the ores of other metals. It is scarcely ever free from some admixture of other metals, particularly of silver. Cramer observes, that such as is found loose in earths and sands, generally contains more silver than what is lodged in a solid matrix. To such an admixture is apparently owing the paleness of some kinds of gold; and probably the Malaccisscan gold, said by Flacourt in his history of Madagascar, to be not only paler, but much more fusible than that of Europe, and which has hence been supposed by some to be in its own nature distinct, is no other than a mixture of gold with a certain quantity of silver: it is said to be of considerably less value than the European gold, from which circumstance, (omitted by Boyle and others, who have quoted Flacourt's account,) it may be presumed that it is not regarded upon the spot as being pure gold.

The Brazils, the Spanish West Indies, some parts of the East Indies, and the coast of Africa, afford the largest quantities of gold. Some parts of Europe, also, appear to be rich in this metal: the mines of the Upper Hungary, which seem to be the most considerable in this quarter of the world, have continued to yield gold for upwards of ten centuries.

Peru, Mexico, Chili, and other provinces of the Spanish West Indies, abound with gold, in a variety of forms. It is found both in the sands of rivers, and in mines; intermixed with loose earth, lodged in fissures of rocks, and bedded in hard stones; at the surface of the earth, and at great depths; in dust, in grains, like the seeds of apples, called *pepitas*, and sometimes in considerable masses of an extraordinary size. Reaumur reports, that a piece was shown to the French academy, which was said to weigh fifty-six marcs, or four hundred and forty-eight ounces; and Feuillée says he saw one in the cabinet of Antonio Portocarero, which weighed upwards of sixty-six marcs, or five hundred and twenty-eight ounces. Both these pieces were assayed, and found to be of different fineness, in different parts of the mass; the first was, in one part, twenty-three carats and a half; in another, twenty-three; and in another, only twenty-two: the second was, in one part, twenty-two carats; in another, twenty-one; and in another, but seventeen and a half. It is, however, rare to meet with masses, of the weight even of an ounce; the largest in the British Museum weighs but fifteen penny-weights. Notwithstanding the extensive dissemination of it through those provinces, yet the quantity of the gold, in proportion to the earthy and stony matter mixed with it, appears to be in general exceeding small. According to Frezier, in his voyage to the South Sea, and Captain Bretagh's account, printed in Harris's collection, the common yield is no more than five or six ounces of gold, upon the caxon, or fifty hundred pounds of the mineral: the richest mines afford only ten or twelve ounces; and those which are but just rich enough to pay the charges of working them, yield only two ounces on that quantity. It may be observed, in general, that the quantity of gold in minerals is more variable than that of other metals in their ores, and the profits of a gold mine more precarious; this metal not being formed in any regular veins, or uniformly distributed through any particular kind of earth or stone, but scattered, as it were, here and there, through different mineral bodies: when united with other metals in their ores, its proportion is by no means constant; though, in this case, it is subject to much less variation than when it is barely bedded in earths or stones.

Of the source of the gold in the East Indies and of Africa, we know but little. From Cape Coast, on the coast of Africa, we receive yearly between two and three thousand ounces of gold dust, which is supposed to be collected from the sands of rivers; and some European traders are said to have been witnesses of the richness of the sands in certain parts of that coast. In Hooke's posthumous papers, an account is given of a person having met with great quantities of gold, in the sands of one of the rivers; the sand seeming to grow richer and richer as he advanced further up: in some places, he says, he gained sixty-three grains of gold from five pounds of sand; and he seems, afterwards, to have met with much more profitable spots. Three or four hundred ounces, as I am informed, are collected yearly from the sands of the Gambia, and cast into bars at James Fort, one of our settlements on that river.

It is said that the gold dust from Africa, in its purest state, is from twenty-one to upwards of twenty-two carats fine; but that the natives frequently mix with it filings of brass. This mixture may be distinguished by the hydrostatic balance, the specific gravity of brass not being half so great as that of the gold dust: in this way of examination great care must be taken to make the water penetrate as perfectly as possible into all the interstices, so as to come into close contact with every particle. A little aqua fortis also, poured on the mixture will immediately discover the fraud, receiving from the copper in the brass a blue tinge. It has been suspected, that if the gold be naturally alloyed with a little copper this trial will prove fallacious, and that the natural copper will tinge the menstruum equally with that which is added by art: of this, however, there is no danger, the natural alloy not being in distinct particles, but diffused through each mass or particle of the gold, so as to be covered by the gold, and protected from the action of the menstruum. There are several other means by which this abuse may be discovered: if the dust be spread thin on a piece of white paper, and moistened with any volatile alkaline spirit, as that of hartshorn, of sal-ammoniac, or of wine, the spirit will, in a few minutes, dissolve so much of the copper as to stain the paper blue: stale urine itself has a like effect in an inferior degree; and a solution of crude sal-ammoniac, applied in the same manner, produces a greenish stain.

(TO BE CONTINUED.)

On the liability of the English Silks and Cottons to become faded; and on the superiority of the Silks of France and the Cottons of India in that respect. By Mr. THOMAS ALLSOP.

Madras, Sept. 5, 1825.

SIR—Among the queries submitted in my letter to you of the 28th September last, was one, requesting to know "why English silks or satins do not retain their colour, or whiteness, so long as those of French manufacture?" I believe the cause cannot reasonably be attributed to the change of climate, as in that case I think it should equally affect both:—but that of French manufacture will be found as perfectly fit for use, after a period of twelve or fifteen months, as when first imported; while the English silks, or satins, (particularly *white*,) will have so completely changed as to be rendered useless for any article of dress, &c. The white will have assumed an unsightly *yellow tinge*, and those coloured will be found to have faded considerably. Although I have no pretension to any great knowledge of chemical science, I am led to imagine, that the fault originates, in a great measure, from the method used in extracting the varnish or gum, from the raw silk; and perhaps, also, from some slight inattention in the process of bleaching it afterwards. I think it will be readily acknowledged, by even the most profound chemists, that any article, particularly so delicate a one as silk, must suffer, either more or less, by exposure to the action of sulphurous acid gas, or immersion in acid, according to the degree of strength or purity of the ingredient used, as well as by the length of time the article is submitted to the action of the gas, or remains in the acid. It is, however, for those who are better qualified in this useful science to determine this material point.

The silks manufactured here are all of an imperfect white, but I believe last much longer than the English or French. The coloured silks are scarcely inferior, and stand as well as the best I have ever seen. The scarlet, purple, orange, and other coloured silk shawls, from Bangalore, are really beautiful, and the colours permanently fixed: their colours, mordants, apparatus, and processes altogether, are simple and cheap: their knowledge of chemistry but very contracted. Still, with all these apparent disadvantages, they produce articles vying in point of quality and texture even with the most refined nations in the universe.

It is also worthy of remark, that the English long-cloths, muslins, jaconnets, &c. never retain their original whiteness for any length of time, but assume a yellow tinge, like the silks and satins above mentioned;

nor do they regain it, by any process of washing. Some pieces, after a few washings, are full of small holes, and it is an incontestible fact, that one piece of good Northward 36 Penijum, will wear out three pieces of the best English long cloth. No deleterious ingredient is used by the natives to give their cloths an artificial whiteness—no chemical process is used by them. The cloths are delivered from the loom in their original state, dirty and brown; but when returned from the washerman, or *vunha*, are as white as snow. The only advantage then, is, (if it may be called an advantage,) that the English cloths are much cheaper, and upon minute examination the threads will be found of a more even texture, and more regular, than those of this country. These are certainly advantages; and if some little attention were to be paid to the usual mode of bleaching, by expunging the articles likely to tinge or corrode the cloths, there is no doubt but that English cottons and linen will be of much greater consideration, and in more request, than they are at present.

I do not know how far I am correct in remarking, that I consider the mode in which the bales of cotton for exportation are generally packed, may in some measure, account for the evils above mentioned. I have seen them, and indeed, it is the general custom to compress a considerable quantity of cotton into a very small compass. This is effected by means of strong massive iron frames, and powerful screws of the like metal; so that when the cotton is removed, for the purpose of being packed in gunnies, &c. it is found to be almost a solid mass. Although much space may be saved thereby, on shipboard, and consequently freight money, I should imagine that the cotton must be in some way injured. If this be really the case, and I have but little doubt myself but it is, the natives here have decidedly a very material and obvious advantage in the manufacture of cloths.

I could say much more upon this subject, but it would be a further digression from the intention with which I commenced this letter. I shall therefore briefly state, that my motive for submitting the question alluded to in the first paragraph, originated from the circumstance of my having purchased, about eight or ten months previous to the date of the above letter, a roll of white satin, and after such quantity as was immediately required had been cut off, (which was only a few yards,) the remainder was carefully put by for a future occasion, which however did not occur until about the time mentioned, when I found the colour had changed to a dirty yellow. The silk was rendered completely useless!

I hope that the queries in my last will meet the attention of some of your valuable and scientific correspondents, who may favour me with the required information.

Accept my best thanks for your prompt attention to my communications, and believe me to remain,

Sir, yours truly, THOMAS ALLSOP.

To T. GILL, Esq.

[*Tech. Rep.*

On a mode of preparing Etching-ground for Engravers. By Mr. Edmund Turrell, *Engraver. Abstracted from a paper in the Transactions of the Society for the encouragement of Arts, Manufactures, and Commerce.*

All engravers are aware of the importance of obtaining a good etching ground. Many recipes have been published, to choose from which requires considerable experience; and when the recipe is good, failures frequently occur from the materials not being good, or from an improper mode of compounding them. To obviate these difficulties is the object of this paper.

Asphaltum is the most important material, as we know of no substance which will completely supply its place. Asphaltum, or Jews' pitch, is a solid mineral bitumen, supposed to be formed from inspissated mineral tar. There is an artificial asphaltum obtained from the manufactories of coal gas in London, which bears a strong resemblance to the genuine kind, and which answers equally well for many purposes, but not for etching ground.

There is some difficulty in distinguishing between these two articles; they resemble each other in their fracture; that produced from coal, however, is of a deeper black than the natural, the best of which is of a fine deep dark brown colour. If a small piece of the artificial kind be laid upon a hot iron, the vapour will resemble that produced by a piece of coal similarly situated, and a coaly cinder will remain behind. The smell produced in this instance is very nauseous, as both sulphur and ammonia, are disengaged and may be distinguished. When a small piece of genuine Syrian asphaltum is placed upon a hot iron, it will, if very pure, be nearly all converted into vapour, and the smell is by many persons, considered to be agreeable. The essential oil of turpentine dissolves it completely, and forms a liquid varnish, which resists the action of dilute nitrous acid; and which is therefore used by many engravers, to cover those lines, which, in the process of etching, have been sufficiently bitten in.

The above-mentioned properties of resisting the action of dilute nitrous acid, and its capacity of giving hardness and toughness to etching-ground, render it an ingredient of the very first importance. Burgundy pitch stands next in importance. This is obtained from the *pinus abies*, or Norway spruce fir-tree. The best kind for making etching-ground, is sold in bladders; and when perfectly good, is of an opaque yellow, rather darker than straw colour: by age it becomes dark coloured, and so brittle, as to be rubbed down between the fingers, which renders it much less fit for the engraver's use.

The third and last article is virgin wax. Much of that offered for sale is adulterated with suet, which spoils it for the purpose of making etching-ground, as it destroys its adhesive property. Wax thus adulterated, is soft and clammy to the feel, and is less transparent than when pure. If the surface of fine wax be rubbed with a linen cloth, it will take a much brighter polish than that which has grease in it. When cut into thin shavings with a sharp clean knife, a fine polish will be left upon the cut surface, whilst it will be dull in proportion to the quantity of suet with which it may be contaminated.

These three are the only ingredients necessary to make good etching-ground. Good asphaltum must be had at any price; the other two can be obtained without difficulty.

General directions for preparing and compounding the ingredients above named.

The asphaltum must be broken into small pieces, and if any pieces of clay or other impure matter are observed, they must be carefully taken out, and then it must be ground very fine in a marble or Wedgwood-ware mortar; and while it is under this process, if any hard stony material is discovered, it must be carefully taken out; it will then be ready to be mixed with the other materials, in the following manner.

Put four ounces of Burgundy pitch into a well glazed pipkin; let it melt gently over a slow fire, and move the pipkin round, so that the whole internal surface may be covered with the melted pitch. Then add four ounces of the ground asphaltum, and let the pipkin remain upon the fire until the two substances are tolerably well mixed, which will soon be effected if the mass be well stirred. Then add four ounces more of the asphaltum, and if the heat be increased, and the mass well stirred, the whole may be incorporated, and will be nearly as fluid as melted pitch.

When the asphaltum appears to be thoroughly melted, it should be kept in that state for at least a quarter of an hour, the heat being a a little lowered, but it must be stirred all the while, by which means a large portion of the moisture of the Burgundy pitch will be evaporated; and the essential oil of the pitch will be thoroughly incorporated with the asphaltum, and render the etching-ground more perfect; for, when this is omitted, evaporation takes place from the ground when spread upon the plate, after it has been laid on for a month or more, and sometimes in a shorter time, a circumstance which very often produces considerable difficulty to engravers, because when that takes place, the ground is rendered brittle, and frequently chips or flies from the plate, to the great detriment of the tints or lines ruled upon it. When the asphaltum and Burgundy pitch are thus prepared and incorporated, add six ounces of the best virgin wax, and keep the whole well stirred till it is completely mixed, and let it simmer gently for about ten minutes, when it may be taken from the fire, and suffered to cool until it is of the consistence of turpentine, or very thick treacle, and in that state it may be poured out upon the clean surface of a copper-plate, or well glazed earthenware dish, in portions sufficient to make a ball, which may in general weigh about an ounce, and when it is sufficiently cold, it must be rolled up into balls by the hands, and kept perfectly clean for use, provided it is found upon trial to be of the proper consistence, but this cannot be judged of until it has been laid upon the plate for a few hours. If it is too soft the etching point will make the lines of unequal breadth, or, as they are technically called, will be drag-lines, being in some parts very fine, and in others very gouty or thick. If it is too hard, the etching point will cause the lines ruled on the ground to chip, and then the edges will be notched or serrated, which would be very prejudicial to the appearance of fine even tints.

There is also another property that may be wanting where the proportions are not properly adjusted, namely, that of spreading kindly on the copper-plate. This fault in ground may be easily remedied, by the addition of a proper quantity of Burgundy pitch.

As each of the evil qualities above-named are likely to happen, on account of the different properties of the materials: and as, on that account, *general principles* or directions will be much more acceptable than mere arbitrary recipes, I shall now endeavour to lay down such *general rules*, that when either of the faults before described occur it may be immediately remedied.

In the first place, asphaltum makes the ground hard and tough, therefore if it wants that quality, more asphaltum must be added, but it must be previously dissolved in a proper proportion of Burgundy pitch, for otherwise it will be very difficult, if not almost impossible to get it thoroughly incorporated, after the virgin wax has been added. The propriety of this caution will be evident, when it is considered that Burgundy pitch is the *real solvent* for the asphaltum, and must therefore at all times be incorporated with it first; and for this reason it will always be the best way to make the ground rather too hard than too soft, because it is much easier to soften it than to make it harder.

Should the ground, upon trial, be found too hard, a small quantity of virgin wax may be added, which is all that is necessary to answer that purpose.

If, upon trying to lay it upon the copper-plate, it does not spread kindly, but clings to the dabber, and only partially covers the surface of the copper, this fault may be remedied by adding a small quantity of Burgundy pitch; but should this property prevail, and the ground also appear upon trial too soft, then Burgundy pitch and asphaltum must both be added, after they have been thoroughly incorporated together; for the principal circumstance to be attended to in making etching ground, is completely to dissolve the asphaltum; for although all the recipes I have read or heard of, direct the Burgundy pitch to be added *last*, yet I am convinced, from much experience, that as Burgundy pitch is the true solvent for asphaltum, these two ingredients should be first thoroughly mixed, by which means only can the real and beneficial effects of the asphaltum be fully obtained.

From what has been stated above, the following general rules or principles are deduced:

First, that asphaltum gives hardness and toughness to etching ground, and is indispensably necessary, on account of its valuable property of resisting the action of dilute nitrous acid.

Secondly, that Burgundy pitch acts as a perfect solvent for the asphaltum; and, when mixed, acts also as a vehicle to spread the ground over the surface of the copper-plate, a property essentially necessary to prevent foul biting.

Thirdly, that virgin wax assists in softening the ground, and giving it such a consistence, that when lines are cut through it by the etching point, the edges of each line will be extremely clear and free from flaws or chips, which would be destructive of the beauty expected from the etchings of the present improved state of the art of engraving.

I beg leave to observe, in conclusion, that my principal object in this communication, is to lay before my brother artists the result of several years experience, gained by careful practice, rather than submit to them novel experiments or arbitrary recipes which fix no useful or general principles in the mind, without which every attempt to modify or alter the composition, must be attended with uncertainty, and too frequently with disappointment.

ENGLISH PATENTS.

Patent granted to James Kay, *of Preston, Lancashire, for machinery for preparing and spinning flax, hemp, and other fibrous substances, by power.* Dated July 26, 1825.

The preparation of the flax used by the patentee is to macerate it in water as it is drawn out in slivers, previous to being spun. For this purpose he uses the common machine for drawing out the flax into narrow slivers; but instead of passing it to flys and bobbins for spinning, he places long narrow cans to receive it, which convey it into perforated vessels, into which they fit, and which are fixed in troughs containing water. When the slivers of flax are coiled up in the cans by the action of the machine, they are pressed down by a sort of pistons or rammers into the water, till all air is separated from between the fibres; and when the lower vessels are full, they are separated from the cans, and after being left for six or more hours, for the flax to macerate, are taken to the spinning machines, where their contents are transferred into other troughs, by turning them upside down, and the ends of the slivers being then placed between the rollers, are spun in the usual manner.

The spinning machines differ only from those in use in having the retaining rollers placed much nearer to the drawing rollers, the distance between them being, in the machines of the patentee, merely two and a half inches; the retaining rollers in these are preferred by him to be fluted, and to be made to revolve one turn only for every eight of the drawing rollers.

This close position of the sets of rollers, the patentee states, is permitted by the maceration of the flax, which allows the rollers to draw out the fibres in much shorter lengths than would be possible without this operation, by which means much finer thread can be made from the same materials, which arises, we suppose, from the fineness of the fibres thus drawn out, bearing a due proportion to their shortness.

The machines are represented in the drawings of this specification as being of the vertical sort, with the sets of rollers placed one above the other, instead of being in a horizontal plane, as others are made, for the same purpose. This position gives them the advantage of requiring no revolving belts, or other apparatus, to convey the slivers from one set of rollers to the other, and will also enable them to take up less space in the factory.

The management of flax is only described by the patentee; but it is easy to conceive how other materials of a similar nature are to be prepared and spun from these directions; and also how the machines are to be set in motion by the power of any of the usual first movers, though no precise instructions are given for this purpose.

Patent granted to Sir Robert Seppings, *Knight, Somerset-house, London, for an improved construction of such masts and bowsprits as are generally known by the name of made masts and bowsprits.* Dated January 19, 1826.

The object of the patentee is to make large masts with small balk, in more numerous pieces, by which their cost will be considerably less than when made, as usual, of large Riga fir, in fewer parts, of greater dimensions.

The head and the heel of each of the masts of this new construction are to be made of the same shape, in order that they may be turned upside down in case of accident.

Masts of this description are to be formed of several pieces of balk, connected together by trennels, coaks, bolts, and hoops. When the mast is to be more than 33 inches diameter, the size of the balk is to be found by dividing its diameter by 4. The core of this mast is to be made of four pieces of balk of these dimensions, joined together by trennels, 1½ inch in diameter, passed through them diagonally, 18 inches apart. As balk of this sort cannot be got of the whole length of the mast, the different lengths are to be so arranged that no two joints may lie in the same transverse section. 2ndly, That they may be as nearly as possible at equal distances from each other; and 3dly, that they may be in those places over which the hoops are to pass: which hoops being five inches broad, each butt, where they meet, will be secured by half the breadth of the hoop, or 2½ inches of iron banding. The ends of these pieces of balk are to be united by coaks, 3 inches in diameter, and 6 inches long; and they are also to have coaks of about the same dimensions placed between them laterally. About this core eight other lengths of pieces, of the same thickness, are to be placed, two at each side, close to the first pieces; and four more lengths of pieces, cut of an angular shape, so that their sections will be similar to the quadrant of a circle, are to be placed at the four vacant angles, making the number of pieces, altogether, 16, at the transverse section of the mast; which mast being then shaped and tapered at each end, so as to fit it for being placed with either end uppermost, as first mentioned, and having iron bolts driven from side to side, through all the pieces, at due distances from one end to the other, is to be further strengthened by having the hoops before mentioned, 5 inches broad, and $\frac{3}{8}$ths of an inch thick, placed round it at intervals $1\frac{1}{2}$ foot apart from each other throughout. These hoops, for the thick part of the mast, are to be made each of two semi-hoops, with ends turned out, pierced, and tapped, for the admission of strong screws, by which they are to be drawn together tightly; but the hoops for the smaller and tapering parts, at the ends, are to be of the common kind, and when in their proper positions, are to be put on in the usual manner. It will easily be understood that the rule for arranging the ends of the pieces of balk for the core, will also apply to those of the surrounding outside pieces, and that they are to be coaked together, both endways and sideways, in a similar manner, and to have their ends placed in the line of the hoops as before mentioned. The patentee states that scarfs may be also used for connecting the ends of the pieces of balk, but that he does not recommend this method, thinking that by the coaks preferable.

The timber used for making these masts, is directed to be well dried and seasoned before the pieces are put together; the holes for the trennels, and for the coaks, and the trennels and coaks themselves, are also recommended to be well painted, or coated with coal tar, previous to this operation.

The directions for making masts of the same sort, under 33 inches diameter, are nearly word for word the same as those already stated, and are repeated throughout in the specification. We shall, however, only notice the difference between the two methods, to avoid the needless tediousness of the other mode of explanation. To calculate the size of the balk for these smaller masts, the diameter of each is to be divided by 3, which will give the measure of the side of each piece. The iron hoops for them are to be of the same breadth as for the others, but are only to be $\frac{1}{4}$th of an inch in thickness, and the pieces of balk are to be fastened together likewise in the same manner, with trennels, bolts and coaks; but an extraordinary direction is given for the dimensions of the coaks for joining the ends of the pieces of balk, which coaks for those smaller masts are ordered to be "3 *feet*" long, and 5 inches in diameter, which we suppose to be caused by some mistake, either of the patentee, or of the person who engrossed the specification.

FRENCH PATENTS.

Brevet d' Invention for fifteen years granted to MADAME CHAUVEAU, *of Montlouis, Widow, for a new manner of manufacturing rice from potatoes.* Dated August 1, 1805.

The potatoes after being taken out of the water, (in which they have been boiled, we suppose,) are left to drain for a night, after which they are taken in lumps, and forcibly passed through a brass colander or sieve, held above a tin plate or tray, having a border round it about an inch high. The substance of the potatoes pressed through the colander, falls like snow, on the tin tray, and is permitted to fill it as high as the top of the border.

The trays filled in this manner are carried to an oven, which should be equally hot as for bread. When the substance is done enough will be known by its becoming detached from the trays; then it is to be drawn from the oven, and beaten a little in a large mortar; and when it is reduced to bits about the thickness of a macaroon, it is to be passed into a mill of the sort used in making snuff, where the pieces are divided unequally. The matter having undergone this sort of grinding, is passed through different sieves, to divide it into rice of three species of thickness, and into rice flour.

The idea of preparing potatoes in this manner, originated, we believe, with M. Pictet, of Geneva. In the Journal of the Lyceum of Arts of Paris, in 1796, M. Grenet, has given an account of a good process for obtaining granulated potatoes, copied from that of the professor mentioned, and has described a very convenient apparatus for the purpose; a print of which, with a translation of the account of the process, will be found in the third volume of our first series.

The process might be advantageous for preparing a useful and wholesome article for sea store, that would keep better than common potatoes, and not be liable to vegetate; but as for the notion of converting potatoes into rice, or into flour, or into any thing else extraneous to their nature, which has been so often proposed, we believe it to be entirely chimerical, and either to originate in self-deception, or in a culpable intention of adulterating rice with an article made to resemble it in some respects, but which possesses nothing of its delicacy and freedom from flavour, and contains much more mucilaginous matter, and much less of a farinaceous nature.

We think M. Grenet's process, in all respects better than that of Madame Chauveau, except as regards the baking; though it is most probable that a stove would dry the granulated potatoes better than any oven, and with much less risk of either burning or scorching them. [*Repertory of Patent Inventions.*

To James Butler, *of the Commercial-road, in the parish of Lambeth, in the county of Surry, for his New Invented Method of making Coffins, for the effectual prevention of Bodies being removed therefrom after Interment.*

This invention appears to be not a new method of making coffins, but a peculiar mode of fastening on the lid after the body has been introduced into the coffin, which the specification states to be "a new method of so effectually securing a coffin, that when the lid is fixed down by an original screw, it cannot be withdrawn, or the body abstracted."

The interior of the coffin is to be lined or bound with plates or ribs of iron, and in the lower part of the coffin within, there are to be holes with screw threads tapped in them. The lid having been placed upon the coffin, long screws are introduced into counter sunk holes, and passing through the lid, and through holes in the side ribs, down to the bottom of the coffin, enter into the tapped holes above mentioned, by which means the lid is secured to the bottom.

But the particular feature of the invention is the fastening screws, the heads of which are made with a screw thread, tapped, in place of the cut or slit usually made in the head of a screw. Instead, therefore, of applying an ordinary screw driver to wind the screws into the holes, a winch or lever is screwed into the thread; in the head of the screw, and by that means the screw is driven down to its intended bearing, (that is, until the head is bedded in the counter sunk hole of the lid;) and when the lid has been thus made fast, the winch or lever being turned the contrary way, comes out of the head, and leaves the screw fast in the coffin.

The head of the screw having been case hardened, a cut or cross groove cannot be afterwards made in it, so as to allow of the screw being turned the contrary way, neither can any instrument be introduced to withdraw it, as the edge of the iron plate into which the head is imbedded, effectually prevents it from being taken hold of. Enrolled, October, 1825.

To William Hurst *and* John Wood, *both of Leeds, in the county of York, Manufacturers, for their invention of certain improvements in Cleaning, Milling, or Fulling Cloth.*

These improvements consist in employing steam in the operation of fulling or milling woollen cloths, instead of soap and water, as heretofore. The machinery is the same as the ordinary stock used for fulling, into which the cloth is to be put and beaten, and turned over as usual; but in place of the soap and water commonly employed for wetting the cloth, a pipe, leading from a steam boiler, is introduced into the back or side of the stock, and the steam is made to blow through a number of small holes, so as to insinuate itself among the cloth, which by that means becomes thoroughly wetted, and all dirt and greasy materials are effectually driven out of the cloth by the steam.

As in this process the presence of water is objectionable, a waste pipe is placed in the bottom of the stock, to carry off the condensed steam. By these means the steam enters into all the folds and meshes of the cloth, and completely supersedes the necessity of soap, which effects a very considerable saving in the process, and allows it to be conducted with greater ease than by the old method. Enrolled, September, 1825.

MECHANICAL JURISPRUDENCE, No. VIII.

BY PETER A. BROWNE, ESQ.

On the Law of Patents for New and Useful Inventions.

Letters patent, *Literœ patentes*, are writings of the executive power, sealed with the seal of state, whereby persons have authority to do or enjoy *that*, which they otherwise could not.

They are so called, because they are *open*, addressed to *all*, with the seal affixed; and ready to be shown for confirmation of the authority thereby given.

Patents are a species of *Monopoly*.

A monopoly may be defined to be, "an allowance to any person or body politic, of the *exclusive* buying, selling, making or using any thing whatsoever;" whenever this allowance interferes with the general freedom of trade or occupation, by restraining the right of buying, selling, or using any thing.

The power to grant it, has been considered an *odious prerogative.* It is said, upon high authority, that restraints upon the trade of the community, in favour of particular favourites of the crown, are contrary to the fundamental principles of the common law of England; and it cannot be denied, that there are ancient precedents of prosecutions against persons who had set up such claims.

History, however, informs us, that in the reign of Queen Elizabeth, monopolies of every kind, were exercised to an enormous height: almost every branch of trade was carried on, under a royal grant, of exclusive privilege. But in the 44th year of her reign, the Court of King's Bench, gave them a death blow. The case was this. The Queen, by her letters patent, granted to one Ralph Bowes, the exclusive privilege of making, and importing, playing-cards. One T. Allein was sued for a breach of this patent right, and he, having admitted the making of part of the cards, pleaded his right to manufacture them, *according to the laws of the Kingdom.*

To this plea the plaintiff demurred; the cause was solemnly argued by the ablest counsel. The court delivered their opinion that the *exclusive* grant of the queen was *void.* They observed, that all trades were for the public good, for the exercise of youth in labour, and therefore that they could not be appropriated to *one solely.*

It was, most probably, owing to this decision, that King James the first, shortly after his accession to the throne, wrote a book, in which he stated, among other things, that monopolies were contrary to law, and he commanded, that no one should thereafter solicit him to grant any such privilege. This book was published in 1610, and 13 years afterwards, the parliament of England passed their famous Statute of Monopolies, reiterating the same sentiment.

Then, according to the common law of England, and this declaratory statute, (which having been passed before the settlement of the United States, was binding on our forefathers,) monopolies *derogatory to the common right of trade*, are illegal, and cannot be granted to, or exercised by any one in this country.

To this it may be proper to add, that even if the right to grant such monopolies had existed in England at the time of our colonization, being one of the royal prerogatives, it would have been abolished by our revolution; and cannot exist here, as it is inconsistent with our free constitutions, which are founded on the principle, that "the right to acquire, possess and protect property, is *general* and *indefeasible.*"

To grant to *one* citizen, an *exclusive* right to use that which belongs *equally to all*, is unjust, and iniquitous; but it is not so, to *secure* to a man the exclusive privilege, for a limited time, to use the productions of *his own genius* or *reflection.* If a person is entitled to the products of his manual labour, why shall he be deprived of the avails of his *intellectual exertions.* They are both equally his own, and he may use them in secret, and destroy them when no longer wanted, without incurring any moral guilt. If he imparts them to another, cannot he stipulate for a consideration, and a covenant not to disclose the secret to his disadvantage? and if, instead of disclosing it to an *individual*, the inventor makes his contract with the *public*, may he not do it upon the same conditions? There is then nothing unjust, or iniquitous, in securing to the *author*, the exclusive privilege of using *his own invention* for a certain number of years, in consideration of its ever after becoming public property.

This contract is equally advantageous to the individual, and the state; to the individual, it secures, for a limited time, the products of his own exertions; and when, at the expiration of that period, the invention is cast into the common stock of property, to be freely used by all, the state is fully compensated for the protection she has granted. Nor is there any thing in this doctrine, which contravenes the principles of the common law; for by that law, the king had the power of conferring on the *inventor* of any useful art or manufacture, the exclusive use of it, for a reasonable time.*

General rules of construction of the Patent Laws.

It is next to impossible to lay down any *general rules* for the *construction* of the patent laws, which will be applicable to all cases; but under the *above* head, it is thought proper to introduce some rules that have been judicially recognized, and which do not strictly fall under any other.

1. It is said that in England, grants flowing from the royal bounty and grace, are generally construed most favourably for the king.

2. As, in the United States, the patent is a *constitutional right*, the above rule has no application here.

3. The patent, in England, usually contains a proviso, that it shall be construed most favourably for the patentee.

4. As there is no such proviso in the American patents, no such construction can be required.

5. It will also appear by a recurrence to the English cases, that their courts have, at different times, adopted arbitrary rules of construction, accordingly as they thought the patent laws, politic, or impolitic. Formerly, they confined the patent within very narrow limits, giving the specification only a *literal* meaning; on the other hand, Justice Buller, in Turner *v.* Winter, 1 T. R. 606, declared that he had always had a strong bias in favour of patentees: and Lord Kenyon in Hornblower *v.* Boulton, 8 T. R. 98, confessed that he was not one who favoured patents.

6. The rule which applies to the United States, is the one laid down by Lord Elden, when C. J. of the Common Pleas, in the case of Cartwright *v.* Armat, viz. that the patent is a *bargain* made between the patentee and the public; and that it must be construed upon the same principles of *good faith*, that regulated all other contracts.

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* Godman on Patents, 44.—and the authorities there cited.

The rules of construction arising out of the different parts of this contract, will be noticed in their respective places.

We come now to speak of the *qualifications* of a *valid* patent. These are, 1st. The *personal* qualifications of the patentee. 2nd. The qualifications of the *invention* or *discovery*. The personal qualifications of the patentee, apply to him, as being a subject or a citizen, or as being an alien and resident.

As being a subject, &c.

The statute contains no restriction, confining the grants to British subjects, and foreigners are permitted to take out patents; nor is there any restriction in this respect, in the United States Constitution. But the act of Congress of the 21st February, 1793, limits it to our own citizens. The words are, "When any person or persons being a *citizen* or citizens of the United States, &c.

Mr. Fessenden in his essay on the law of patents, says, that patents can be legally obtained by none but those who are *native* citizens, their heirs or assigns.' This is an error, the word citizen, in the act of Congress, includes all, whether *natives* or *naturalized.*

As to aliens and residents.

By the 1st section of the act of Congress, passed the 17th day of April, 1800, all the benefits of the former act, are extended to all aliens, who, at the time of petitioning, &c. shall have resided for two years within the United States.

The act declares, that the privileges shall be obtained, used, and enjoyed, by such persons, in as full and ample manner, and under the same conditions, limitations and restrictions, as by the said act is provided and directed in the case of citizens of the United States.

The section then contains a proviso limiting the enacting clause; it is in these words, "*Provided always*, that every person petitioning for a patent for any invention, art or discovery, pursuant to this act, shall make oath, or affirmation, before some person duly authorized to administer oaths, before such patent shall be granted, that such invention, art, or discovery hath not, to the best of his or her knowledge or belief, been known, or used, either in this, or any foreign country; and that every patent which shall be obtained pursuant to this act, for any invention, art or discovery, which it shall afterwards appear had been known or used previously to such application for a patent, shall be utterly void.

This proviso puts aliens on grounds somewhat different from those of a citizen, for while the law requires, in the case of a citizen, that the discovery should be unknown, and not used as the invention of any other than the patentee, before the application for the patent, this proviso, in the case of an alien, requires that it should not have been used, before the application for a patent, by *any one*, whether the *patentee* or another.

This important distinction is pointed out in the case of Huntington *v.* Morris, M. S. rep. c. c. U. S. for the Southern District of New York.

Judge Thompson says, "in reference to the objection drawn by the defendants' counsel from the first section of the act of 1800, placing aliens on the same grounds in certain respects as citizens, I consider it not sound. This section first proceeds to extend the benefits of the patent law to aliens, equally as they are enjoyed by citizens, and under the same limitations; aliens must take the same oath as to being the inventors, &c. Then comes the proviso, requiring them to swear that the invention has not been known, or used, in this, or any foreign country. This proviso is a limitation on the enacting clause, according to the general rule of construction, and is to be construed as limiting and restraining the grant to which it is applied. It puts the alien on grounds somewhat different from those of a citizen, requiring an oath of something more than is required of a citizen, and this view strengthens the construction given above, to the first section of the act of 1793. Then the clause of the proviso goes on to state, that if it shall appear that the thing patented, had been known or used previous to the application for a patent, the patent should be void. It seems reasonable to restrict an alien in this manner, from taking out a patent for what had been in use abroad, inasmuch as our own citizens could not patent a foreign invention."

Two or more persons who are the *joint* inventors may take out a *joint* patent.

This was decided by Judge Story, in Barnet *v.* Hall, 1 Mason's reports, 472; he observes, "In the first place, a joint patent may well be granted upon a *joint* invention. There is no difficulty in supposing in point of fact, that a complicated invention may be the gradual result of the combined mental operations of two persons acting together, *pari passu* in the invention; and if this be true, then, as neither of them could justly claim to be the *sole* inventor, in such a case, it must follow, that the invention is *joint*, and that they are *jointly* entitled to a patent.

And so are the express words of the patent act, which declares, that if any person, or *persons*, shall allege that he or they have invented, &c. a patent shall be granted to him, or them, for the invention."

An Essay on the Bombyx Mori, or Silk Worm, read before the Maclurean Lyceum of Science of Philadelphia, June 11th, 1826, by JOHN T. SHARPLESS, M. D.

(Continued from p. 29.)

As the cocoon is the valuable part of the labours of the silk worm, every means should be discovered, and practised, to ensure a good crop. The quality and quantity of the thread, depend on the diet, upon the care bestowed, the breed, &c. The white mulberry is, undoubtedly, the best food; they will, however, live, and even thrive, on other vegetables. In Calabria, the red is preferred, as it is thought to produce a stronger silk; and in Granada, the trees are all of the black kind. If a worm is furnished with a mixture of the three kinds, it will first eat the white, then the red, and lastly, the black. The Tartarian mulberry, ranks with the red in point of goodness. It is also said they will live on the paper mulberry, dandelion, cowslip, blackberry, elm, &c.; but that they do not thrive when thus fed. It was before remarked, that lettuce was used, when the right food could not be obtained. but it is generally thought that they will not flourish, or spin good silk, when fed on this vegetable.

Miss Rhodes, of England, supposed this to arise from the coldness of the food, and on this intimation, General Mordant tried the experiment, of keeping the room and food quite warm, and completely succeeded in producing a good crop; he, however, made but one trial. If this should be confirmed, it would be better to cultivate the cabbage lettuce, as more economical than the mulberry, and as the internal leaves are always dry, even in rainy weather, we should not endanger the lives of the animals in a wet season.

A new mode of preparing the food of the worm, has been proposed by Dr. Bellardi, a botanist of Turin; which mode he considers original, but, according to Duhalde, the Chinese have followed it for a long time. His plan is to collect the mulberry leaves in the autumn, whilst in their prime, and dry them in the sun; they must be finely powdered, either in the winter or spring, and slightly moistened when used. On this the animal feeds greedily, and will even eat it after having enjoyed the fresh leaves.

The number of times they are fed has a great effect on the silk produced. The Chinese by frequent feeding, bring them to maturity in twenty-three days, instead of forty-three, whilst the quantity, and quality, of the silk are vastly improved. "A quantity of worms weighing but a drachm, on emerging from the egg, will produce twenty-five ounces of silk. If the maturity is delayed to twenty-eight days, but twenty ounces are raised, and if they are near forty days, but ten ounces." No experiments have yet been made in this city on this subject, but it probably holds equally true.

I have already made some observations on the care necessary to be bestowed on the worm, and have remarked that their ordure should be removed every day. This is, undoubtedly, the safest plan, though from some experiments of Dr. Anderson, it would seem that even this was unnecessary. He found that by strewing fresh slaked lime in powder, over the moveable drawer in the machine already described, all disagreeable scent was removed, and the gases which injure the animal, neutralized. Mr. Blancard proved that carbonate of lime would answer the same purpose; this he did by placing some worms in bottles, during the time between their different changes, and not removing any of their dirt or litter: in some of the bottles he sprinkled powdered chalk, and in others, none: those that had the chalk, produced full sized, first quality cocoons, whilst the others spun small, and very imperfect cods. The chalk, however thick it was spread over the worm, did not in the least incommode it. He also recommends that the walls of the rooms be occasionally white-washed.

As the breed of the animal is of great consequence, we should be careful to procure eggs of the best kind. I have before remarked, that Spain generally produces the best quality in [illegible]; the northern

Italian worm, is also good, and Mr. Alexander possesses a Friuli worm that is probably equal to any Spain can yield. In the Hospital of this city there are two breeds, that differ somewhat in their shape and marks, the best of which came from Genoa; the other has been a good worm, but as they all will, when neglected, it has degenerated, now producing a small, long, yellow cocoon, and the quality of the silk is very inferior; whilst the other displays a large, round, white cod, vastly superior in quality. The Chinese writers, according to Duhalde, in giving directions for the preservation of a good breed, say you must expose your eggs at the same time, to precisely the same heat; they will then, if healthy, all hatch on the same day; and those, therefore, that come out, either before or after the mass, are kept separate from the rest, and are never preserved for seed. Of those cocoons that are preserved for eggs, the flies that appear before, or after, the second day, are discarded, as being unhealthy and unable to lay good eggs. Even of those that come under the above description of good flies, they still have their choice, throwing away those that have "bended wings, bald eye brows, a dry tail, and reddish, blue, or yellow, body."

I have not been able to ascertain, positively, whether the black or white worm is the best, though many prefer the black; neither do we know the cause of this difference in colour, whether produced by food, or culture, or whether it is a distinct variety of the animal; they will, however, intermix, and produce other shades of colour.

As at the end of five or six days, the animal has ceased his spinning, the cocoons that are to be reeled immediately, may now be used, but those that are to be kept for use at another time, must have their inhabitants destroyed, or they will make their way out. There are several colours of the cocoon, as white, fawn, yellow, greenish and orange; but I have never seen the fawn coloured, as the production of any but the Genoa or Friuli worm. They are divided into several classes or kinds, which are to be kept separate; colour being little regarded, though the white is considered rather the best, next the straw colour, and lastly the orange. The orange is thought to be the strongest silk, but the white, the finest. The cocoons from the mountains, are better than those of the plains, from the more healthy nature of the animal. There are also generally more white cocoons among them.

There are, first, the *Good* cocoon; these are strong and firm, nearly equally round at each end, not very large, and free from spots. There is, a second good cocoon, that is called the *Calcined*, where the animal has died and been reduced to powder, which may be known by the sound, when shaken, and bring, in Piedmont, one half more price than the others. The third, or *Choquette*, is also a good cocoon, producing fine silk, but the insect having died before it had finished spinning, it is apt to furze when wound. In these, the animal cannot be shaken from end to end, but sticks to the side. The fourth kind is the *Cocalon*, these are rather larger than the *Good*, but produce no more silk, the texture being loose and soft. The fifth is called *Dupion*, or double cod, because they contain two or more larvæ, which have their threads interlaced so much, that they cannot easily be wound, and are, therefore, often kept for seed. The sixth is the *Soufflon*, where the texture is so loose, and transparent, that the worm can be seen; these cannot be wound. The seventh is the *Pointed*, where the ends, from their sharpness break off, and the thread is spoiled. The eighth is the *Perforated*, where the moth has made its way out. The ninth and last, the *Bad Choquette*, is spotted and rotten, and makes a black silk. The seed are called the *Royal* cocoons.

After the selection for spinning has been made, the animals must be destroyed; to effect which, several means have been pursued. The usual modes have been, to place them in the sun, for a few days, or in an oven, after the bread has been removed; the temperature is then at about 160° or 180°. The Rev. Mr. Swayne of England, who has tried many experiments on the subject, advises that they be dipped in water nearly boiling, for two or three minutes, which, he says, kills the animals effectually, without injuring the silk, as in baking. He is then careful to dry them well in the air. This, however, is disapproved by Miss Rhodes, who says that it will not injure the chrysalides; and mentions this process as a means of saving the silk from those placed away for seed, the animal changing into the Fly, as certainly, after, as before this operation. This agrees also with my own experience. The fumes of sulphur have also been used to destroy the animal, but in vain. The Chinese employ the steam of salt water; and the vapour of fresh water has been successfully used in England, and some parts of Italy. The Rev. Samuel Pullein of Georgia, who published his remarks in 1758, directs that they be placed in layers of four inches thick, on a wicker frame, made to fit over a vessel of boiling water. This is to be closely covered over, and the steam very soon destroys the animal. The cocoons should then be well dried in the sun or free air.

If, however, the usual mode of baking is followed, they should be placed in shallow baskets, in a considerable quantity, and put in the oven for an hour; they should then be examined, and one of the middle ones opened, to see if the animal is dead. Great care must be taken to keep them from burning. After this process, wrap the baskets up in a blanket, and if your baking has succeeded, it will be covered with a heavy dew; if this does not appear, they are too much burned, or are not dead, which must be decided by examination. You must leave them thus wrapped up for five or six hours, and those that were still alive will be suffocated. The baking in the oven is unquestionably the most certain mode of destroying the crysalis, as the sun sometimes merely renders them torpid. When the worms are dead, the cocoons must be placed in the air to dry, or they will mould and spoil.

The next operation is winding off the thread. The filament of the *Good* cocoon, winds off much the easiest, and requires water nearly boiling hot. The *Dupion* and *Choquette* require boiling some time, and are then easily wound. The *Cocalon* demands water of a lower temperature than either of the others, and are the most difficult to wind.

If the water is not of a right temperature, the silk will be spoiled, for if too hot, the thread is dead and flimsy, and if too cool, the fibres do not join well, and make a harsh cord.

It has been a very general belief that the *Perforated*, could not be reeled, from the division of the fibres by the animal, but as was before remarked, Mr. Swayne denies the rupture of the threads, and asserts as incontrovertible evidence, that he has unwound several of these cocoons without much difficulty, and has not found a single end at the orifice. This winding must be done without water, or the thread becomes entangled instantly. The filaments thus unwound, although stained by what has been called the corroding liquor of the insect, he asserts was as strong and uninjured as from any other part. It is necessary that the water used in reeling be soft, as river, pond, or good rain water; spring, or well, or lime stone water, not dissolving the gum.

The floss silk is first removed from round the ball, and put away for carding. The balls are then thrown by handfulls into a copper placed upon a furnace to keep the water of a proper temperature. The cocoons are then stirred about with a stiff wisk, about six inches long, to this the ends of the thread will stick, and can then be raised. These ends should be cleaned between the fingers, from all the loose silk, and gum, which operation is called, by the French, *La Battue.*

When the threads are clean, pass four of them through a hole, of which there should be several, in an iron plate fixed across the vessel. As many of these collections of filaments are placed together as will produce the quality of thread desired. These ends are twisted together several times, and then attached to a reel. The fibres of the cocoon are connected together by a gum which surrounds them; this is softened, but not entirely dissolved in the water. To prevent, therefore, the different large threads sticking together on the reel, and producing a rough silk, the French winders are compelled to allow a space of thirty-eight inches between the copper and the axis of the reel, and also have attached to the machine, a traversing arm, carrying the threads backwards and forwards, covering a space of two or three inches, so that the fibres may not come in contact with those immediately preceding, but have time to dry. (See plate Rees' Cyclopedia, Art. Silk.) As the filaments break they must be renewed, and when the balls are half unwound, more must be added, as the silk becomes much finer as it passes toward the centre, one fresh thread being equal to two, half wound. This addition is made by attaching the new fibre to the mass, and giving it a twist. When all the good silk has been wound off, the inner case or husk, or, as the French say, *Biarré*, breaks up, and makes the thread foul and lumpy. These husks must be removed and opened, the insect within being good food for poultry, whilst the shell is placed among the other offal, to be carded.

The water from which you wind, must be changed frequently, as it becomes full of little filaments, and of the gum. The worm also discolours the fluid, and spoils the beauty of the thread. The *Dupions* or double balls, and *Choquetles*, are generally used for sewing silk, and fifteen or twenty are placed together for that purpose. In winding you will meet what are called *Bassinots*, that are full of knots, these should be removed and thrown among the rough silk. The husks, and indeed all the waste silk, except the floss, is boiled with potash before being carded, and all, when spun, forms a strong coarse silk, called *floretta*.

Round each filament of silk, I have before remarked, there is a fine coat of gum, this forms nearly one-third of the thread, and is soluble in water, but not in alcohol; it is precipitated by many chemical agents; and when the water is evaporated, in which it is dissolved, a black, brittle varnish is obtained. There is also another substance resembling resin, which alcohol will dissolve, and the silk deprived of this becomes of a beautiful white colour.

The quantity of silk obtained from the cocoons must now be considered. The general length of the thread is from two to five hundred yards, and some are even said to be six miles in length. The experience of silk raisers has been very different as to the quantity of silk to be procured from a given weight, or number of cocoons. L'Abbé Sauvage says, that with good management, one ounce of seed, or forty thousand worms, will produce one hundred pounds of cocoons, but with ordinary care, only fifty pounds. Mr. Murray, a writer in the Trans. Soc. for the Encourag. of the Arts, states that in Varese, the product is from fifty to sixty pounds. But almost every writer differs as to the quantity of reeled silk derived from a given number of the balls. Mr. Chazal, of the Isle of France, produced one hundred and eighty French ounces from fifty-five thousand cods.

Mr. Salvator Bertezen, by a mode that he has never divulged, obtained	5 lb.	Troy,	from	12,000	cocoons,	which allows	2.04 grs.	each ball.
Mr. Swayne,	5 lb.	do.	do.	13,405	do.	do.	2.14 grs.	do.
Mrs. Williams,	5 lb.	do.	do.	14,640	do.	do.	1.96 grs.	do.
Mr. Pullein,	5 lb.	do.	do.	16,480	do.	do.	1.74 grs.	do.
Miss Rhodes,	5 lb.	do.	do.	21,000	do.	do.	1.37 grs.	do.

The late Dr. Morgan of this city, (*Philos. Trans.*) admits rather less than Mr. Pullein. Reamur, in his report on the feasibility of cultivating the spider, as a source of silk, calculates 3 grs. for each cocoon, but I presume he must have made some error in his weights. In a communication with which I was favoured, a few days since, by Mr. Fitch, of Mansfield, Con. whose answer to the committee of Congress on this subject was published in their report, he says that their ordinary success, is about 5 lb. from 15,000, which approaches, nearly, the estimation of Mrs. Williams. In the report of the Filature of Philadelphia, 1770, they say that one ounce of eggs, or 40,000, will produce 8 or 10 lbs. of silk.

I will now speak more particularly of the mulberry tree, and its cultivation, as a source of food for this important little being. It is called in Botanical language, *Morus*, and of it there are several species. The Alba, Rubra, Nigra, Tartarica, and Paperifera. Considering the Alba, or white, the kind best adapted to the nourishment of the animal, I shall confine my attention to its propagation. Though not a native of our country, it has become perfectly naturalized, and grows in every variety of its soil and climate. Many plans have been proposed for its cultivation, but the most common is by the slip; it is sometimes raised by sowing the seed, in drills, or broad cast: the latter is mown and appears to be principally an American system, it is also said to be practised in India, but has not, from what I can understand, been very successful; the roots dying in a few years. Should it be thought proper to adopt this mode, the land must be good, and prepared as for grain. The seed is to be mixed with about an equal quantity of fine gravel, and sown early in the spring; it soon comes up, but is not gathered till the following spring, when it is about 3 feet high. It is sometimes allowed to remain 2 years, unless the land is very good, and the shoots grow with great rapidity.

The Chinese also sow it broad cast; but only for the purpose of selecting the best plants to remove into their nurseries. They mix an equal quantity of millet with it, which growing rapidly, shields the tender shoots from the sun. In the fall, when the millet becomes perfectly dry, it is set on fire, and burns off all the mulberry stocks, which shoot forth with great luxuriance, the following spring. To prepare the seed for any purpose, the fruit must be gathered when it is perfectly ripe, selecting berries that are not worm-eaten, or blighted: it is also of the first importance that they be gathered from good trees, as, according to the French and Chinese, there is a great difference in the quality of the tree itself. The leaves of a good tree are large, soft, smooth, rather light coloured, and little cut or indented. Duhamel thinks the seed should be gathered in countries where the cold is rather severe, the tree being by that means more hardy, and the leaves equally nourishing. The Rose leaved or Spanish mulberry is preferred, by Mr. Bourgeois, as a stock for propagation, for although any kind of white mulberry will produce leaves enough, they are not all alike in quality. When, therefore, we have chosen a tree for the fruit, it should be trimmed, and all the branches separated, allowing the sun and air to have free access to all parts, and should then be undisturbed till the fruit is gathered. The berries should be well mashed by the hand in water, and after standing in the pulp a short time, the water should be allowed to run off, and a fresh quantity added, and the process repeated, until the seeds remain clear. All the seeds that are light and float, must be thrown away; they should be large, heavy, and rather light coloured, producing much oil when pressed, and crackling when thrown on a hot iron.

(TO BE CONTINUED.)

ON JAPANNING AND VARNISHING.—No. 2.

By the Editor.

In treating upon this subject, the spirit varnishes will claim our first attention, as they are used for a greater number of purposes, than either of the other species.

It is intended in these papers to preserve, in general, a systematic arrangement, but as it will sometimes happen that a recipe may present itself, or a process become known, after we have passed that point which it would have occupied in a perfect system, we shall not, on this account, refuse a place to any thing which is deemed useful.

On Alcohol.—The various kinds of spirituous liquors, derive their strength, their combustibility, and their intoxicating property, from the presence of one ingredient, which is common to them all, this ingredient is denominated *alcohol.* Proof spirit, whether known under the name of whiskey, gin, rum, or brandy, consists of about equal parts of alcohol, and of water; the peculiar flavour and odour of each being derived from the accidental presence of some portion of the article from which it has been distilled, and from which it may completely, although not easily, be separated by rectification. The liquid usually sold under the name of *spirits of wine*, is in general a highly rectified spirit, intermediate between proof spirit and alcohol; but not sufficiently concentrated for the purpose of making varnish. The name however will not serve as a guide, as the two are frequently used without discrimination, and the purchaser fails in his attempt to dissolve the resins, in sufficient quantity to make varnish, in consequence of the weakness of the liquid employed.

The goodness of the alcohol should first be ascertained, and if it contains any notable quantity of water, it must be rejected, or the water must be separated from it, which may be readily done by a method to be presently described. The most common way of testing the strength of the spirit, is to put a small quantity of gunpowder into a cup, and to pour a small portion of the spirit upon it, so as to moisten it; the spirit is then inflamed, and if when burnt out, it fires the powder, the spirit is accounted good; this however is a very imperfect test, as a weak spirit may fire the powder, if but a small portion is dropped on it, the quantity of water which it contains, not being sufficient to wet the powder throughout, whilst a stronger spirit, if applied in larger quantity, may leave a sufficient portion of water to prevent the combustion.

The readiest practical method of determining whether alcohol will answer the purpose, is to fill a large vial with it, and then to drop into it a small lump of potash, or pearlash, which has been heated very hot over the fire, to expel its moisture, and which has not afterwards been suffered to become cold; the vial is then to be well shaken, and if the lump remains dry, or nearly so, the alcohol is good, but if any considerable portion of it is dissolved, it is unfit for use.

Should the alcohol not prove good, it may be rectified, by putting into the bottle in which it is contained, a considerable portion of potash, prepared, and warm as before directed; if there is much water present, the potash ought to be equal in weight to one-third of the alcohol; on shaking the bottle, the water will dissolve the potash, and this solution will fall to the bottom of the vessel, forming two distinct liquids, as separate from each other as oil and water; after this has stood for some time, the alcohol must be carefully poured off, and the same operation may be repeated. The watery solution, and the lumps of potash, may be put into an iron pot, and again desiccated, when it will answer the same purpose, as well as at first.

The above process, will leave the alcohol of a reddish colour, of which it may be deprived by distillation; but this colour is of no consequence whatever in the making of ordinary varnishes, as it will not give a sensible tinge, excepting to the lightest kinds. When it is desired to deprive the alcohol of this colour, and the means of distilling it are not at hand, it may be accomplished by putting into the spirit a small portion of calcined (or burnt) alum, the acid of which will combine with the potash, which will then fall to the bottom. Should the alcohol still retain any colouring matter, it may be rendered perfectly colourless, by filtration through fresh burnt, pulverized charcoal. The method of doing this, and also a simple apparatus, by which any one may accomplish its distillation, will hereafter be described, for the sake of those who live at a distance from large towns, and are unable to purchase it in a state of purity.

There is another mode of trying the strength of alcohol, and that is by its *specific gravity*, or the weight of a certain bulk of it, compared with the same bulk of water; the greater its purity, the less it weighs, and when perfectly pure, its weight is but little more than four-fifths of that of water; suppose therefore you have a vial, which, when filled to a mark made on its neck, holds exactly five ounces of water, the same vial, filled with alcohol, to the same mark, ought to contain but a small fraction more than four ounces. The philosopher may require greater precision, but for the practical man the foregoing method is sufficiently correct, and may readily be employed. It is evident that the size of the bottle is unimportant, provided the weight of the alcohol, which it will contain, is but little above four-fifths of the weight of its contents of water.

On Lac, or Lacca.—Lac is a resinous substance, imported from the East Indies, where it is found on several species of trees; being deposited on the twigs by an insect, the *coccus lacca.* Lac is brought to us in three states, known under the denominations of stick-lac, seed-lac, and shell-lac. The former consists of the resin attached to the twigs, the seed-lac is the same substance separated from the wood, the shell-lac is in the form of thin lamina, or plates. Lac in its native state, contains a considerable quantity of colouring matter, of which it is nearly deprived, before it is exported, as it is employed in India, for giving a beautiful red, and some other tints, to cotton, and other goods.

In the application of Lac to the purpose of varnishing, we shall confine our observations to seed-lac, and shell-lac; and as the latter is the kind most extensively employed, we shall consider it first. The books inform us that shell-lac consists of the seed-lac purified, fused, and run into thin plates. There is however, sufficient reason to doubt the correctness of this statement, as the shell-lac, is much cheaper than the seed-lac, is more fusible, much more easily dissolved in alcohol and forms a softer varnish; it is highly probable therefore, that shell-lac contains a considerable portion of some cheaper resin, with which the lac is fused. at the time of its formation.

Shell-lac varnish.—In making spirit varnishes, it will be found that the resin to be dissolved, may be from one-third, to one-fourth of the weight of the alcohol employed; a complete solution of a larger quantity cannot be effected; and some of the resins used are much less soluble than this. The best shell-lac, is that which is most transparent, and which has the greatest brilliancy of surface. Its hardness is also a good test; of two portions, that which is least easily scratched with the point of a knife, may be considered as the best. To every pint of alcohol, from three to four ounces of shell-lac may be added; glass bottles are generally employed for containing the mixture, but vessels made of tin are much to be preferred, for very obvious reasons. The shell-lac ought not to be pulverized, but may be put into the spirits, in pieces as large as the vessel will admit. In warm weather it is not necessary to place it near a fire, as it will, if frequently shaken, dissolve in the course of a day. Frequent shaking is of importance in making this, and many other varnishes, as the resin will otherwise agglutinate into one mass, and will be afterwards dissolved with difficulty. In cold weather the bottle may be placed near a fire, so as to keep it slightly warm; if much heated, there will be a considerable loss of alcohol, by evaporation; there should be a small notch cut the whole length of the cork, to allow the escape of vapour, when placed near the fire, otherwise the cork may be blown out, and if too close to the fire, combustion may be produced. Those who make spirit varnish in the large way, use a barrel churn, into which the materials are put, and they are agitated until the whole of the resin is dissolved. This is an excellent mode, as there is no loss from evaporation, and the resin is prevented from agglutinating. Shell-lac varnish is never perfectly clear, as the resin contains some matters not soluble in alcohol; when the lac is dissolved without heat, the greater part of this remains at the bottom, but if made pretty warm, it is diffused in clouds through the whole mass, nor can it be separated by filtration; this, however, does not interfere with the goodness of the varnish, and may, probably, add to its toughness. Should the solution prove too thick, more alcohol may be added; this is best done in small quantities, as the varnish is used. Where hardness is not a point of importance, a small lump of common rosin is added to the shell-lac, as this substance increases the brilliancy of most of the varnishes; it ought, however, to be used with a sparing hand, as it renders every species brittle.

Shell-lac is of a yellowish brown colour, and will not, therefore, answer for those articles which would be injured by this tint; it is otherwise the best of the common spirit varnishes, whilst it at the same time, is the cheapest. It answers well upon mahogany, and upon most coloured articles; but when used upon those which are black, it must be made of that colour, in a way to be hereafter described, or it will give an evident shade of brown.

Professor Hare, has discovered a mode of depriving shell-lac of its colouring matter; the process has been made known to the editor, but he does not conceive himself at liberty to publish it at present;

but a communication upon the subject is expected shortly, and will appear in this Journal.

When wood, or other porous materials, are to be varnished, they ought to be coated with some substance which will cause it to *bear out;* the pores may thus be completely filled, and much time, and varnish, saved. For mahogany, and some other woods, boiled linseed oil may be used, particularly if it is desirable to heighten the colour. Thin size, made from common glue, that from isinglass, the glare of eggs, gum-water, or gum tragacanth, are occasionally employed; the object in view, being to prevent the absorption of the varnish by a coating of some substance not soluble in alcohol. When linseed oil is used, it ought to be rubbed on sparingly, then wiped carefully off, and a day or two should be allowed for it to harden, before the varnish is put on.

For ordinary work, the varnishing brush may be a *sash-tool* of a suitable size, as the varnish, if not too thick, will flow and spread itself evenly, although the hairs of the brush may not be fine. When the varnish is used thin, and the articles to be varnished are of the finer kind, or the surface great, the flat, camel's hair brushes, are to be preferred. In general, three or four coats will be found necessary, and when wood is very porous, or the varnish is to be rubbed down, and polished, double the number may be required. In dry weather, the spirit evaporates so rapidly, that the coats may follow each other, at an interval of a few minutes only; but great care should be taken that the last be perfectly dry, before another is laid on. It frequently happens, that the varnish assumes an opaque white appearance, as it is laid on, losing all its brilliancy. This is occasioned by the moisture in the atmosphere, and indicates that a close room, and a fire, are necessary; and without these it will be useless to persevere. The transparency will, however, be restored by the next coat of varnish, if laid on in a place that is warm and dry. This frequently occurs, when, judging by appearance, we should think the day most suitable for varnishing.

It will be perceived, that many of the preceding remarks apply to spirit varnishes, in general, as they all possess certain properties in common, and require, therefore, a similar mode of treatment. The mode of polishing, and some other particulars, which will be treated in the next number, will partake of the same character, and will not need to be repeated, when other varnishes are considered.

A description of the American Slide rest, as made by Messrs. Mason & Tyler, of Philadelphia; with the improvements of other machinists.

[WITH A PLATE.]

Where perfect accuracy is required, in turning cylinders, cones, or flat surfaces, the slide rest, is an appendage to a lathe, which is almost indispensable. Those made by Maudslay, and by Holtzapffel and Dyerlein, in London, are justly esteemed, both for their beauty, and the accuracy of their workmanship: and it is no small praise to aver that those made in this city by Messrs. Mason & Tyler, are equal in both respects, and reflect the highest credit upon those artists. The slide rest is applicable to other purposes than those above mentioned, particularly to the cutting of accurate screws, on work in the lathe. This application will hereafter be described.

A, fig. 1. (see plate) represents a piece of metal grooved underneath, to receive the holdfast, as in the common rest, having a circular projection at B, made flat at the top, forming a bed on which the circular base C rests, and is held fast to it by the screw-bolt D, in the centre of the base.

E, the main-bar connected to the base C by the supports F F, made perfectly flat on its upper surface, having the edges parallel and bevelled under, to fit the dove-tail groove, in the lower side of the main slide G; in the top of the main slide is the dove-tail groove, crossing the lower groove at right angles, which receives the cross slide I, on which the cutting tool is placed, and may be held by either of the screws, K.

The screw H, which moves the main slide is supported underneath the edge of the main bar by a collar, P, at each end, to protect it from chips, &c. and works in a semicircular nut, T, which is attached to the main slide. The collars P P being smaller than the screw, permit the nut to pass over them, and the slide to be taken off at pleasure; L, a screw by which the cross slide is moved; it passes through the collar M, on the end of the slide I, and works in a nut formed in the bottom of the groove. At each end of the collar piece M, is a stop screw S, used in turning grooves of uniform depth, &c.

From the foregoing description, it is obvious that the cutting tool may be moved in the direction of either slide, or in lines at right angles to each other.

For turning cones, cylinders, concave surfaces, facing wheels, &c. the rest may be turned around the centre pin D, by which it is screwed down to the bed.

It is believed that this improved rest combines all the advantages of other instruments of the kind, with greater strength and firmness; and it is adapted to the common lathe.

A description of an improved lever press, for cutting, piercing, &c.

By Rufus Tyler, *Machinist, of Philadelphia.*

(WITH A PLATE.)

The screw press is usually employed for the purpose of piercing and cutting metallic plates, for various purposes; it is, however, more difficult to construct, and, consequently, more expensive than the lever press, whilst the latter possesses the advantage of leaving both hands at liberty, to manage the work. For the purposes to which it is applied, it is in all respects equal to the screw press, and in several, superior; the practical workman will at once perceive the excellence of the mode of fixing the bed. This was formerly regulated by screws.

it was attended with great difficulty, and was rarely done with that accuracy, which is attained by the mode here described, with such facility as to render a trial unnecessary.

A, fig. 2, the body of the press, B, a cylindrical slide, working in the box C, which is connected to the lever D by the plates E E, a piece of steel, F, is introduced between the top of the slide and the lever, as seen in fig. 3; the use of which is to present sufficient surface to sustain the pressure, and to preserve as nearly as possible the uniform distance of the centres, which connect them.

G is a punch or cutter, the conical shank of which is accurately fitted to a corresponding hole in the bottom of the slide.

The die seat I, is a circular block of metal, expanding into a flanch at the bottom, by which the hooks K K hold it firmly down upon the flat bed upon which it rests.

By this arrangement the most intricate and delicate dies or cutters may be set with great facility, and the utmost accuracy, by any inexperienced person.

L is a stop screw, to prevent the cutter from entering too deep into the lower die.

The power is applied by the foot at the treadle M, which has a counter balance at N.

Bank Note Engraving.

[WITH A PLATE.]

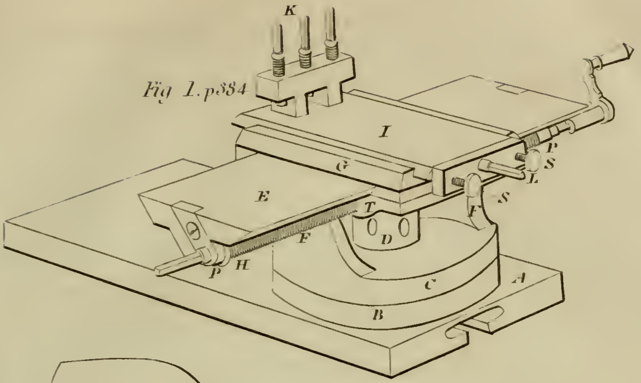
The specimen plate which accompanies this number of the Journal, is from the office of Fairman, Draper, Underwood & Co. of this city; the kind of work which it exhibits, has long been successfully used, for the purpose of preventing counterfeiting. The whole, excepting the words, is performed in the lathe, and is therefore purely mechanical. The instrument by which it is accomplished, is denominated the *Geometric Lathe*, which was invented by Mr. Asa Spencer of Connecticut, but now of this city. An opinion, altogether erroneous, has been prevalent, that it was the product of the genius of Mr. Jacob Perkins; an intelligent gentleman in Connecticut, first suggested to Mr. Perkins its application to Bank notes, as a security against counterfeiting, and he in consequence, engaged Mr. Spencer to carry this suggestion into operation. Mr. Spencer accompanied Mr. Perkins to this city in the year 1816, when the lathe-work was first applied to the notes of the bank of the United States, by Messrs. Murray, Draper, Fairman & Co. When Messrs. Perkins & Fairman went to London in the year 1819, Mr. Spencer was induced to join them. The work was there put to the severest test, which the combined talent of that great metropolis could invent, and after having passed this trial in the most satisfactory manner, it was very generally adopted, and continues to be used by the banks and bankers of the United Kingdom.

The Geometric Lathe differs very materially from every other turning engine, hitherto invented. The only one, the work of which has

SLIDE REST & PRESS

Pl. ** 11.

Fig 1. p384



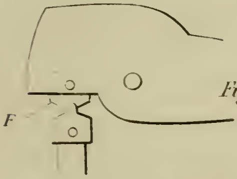
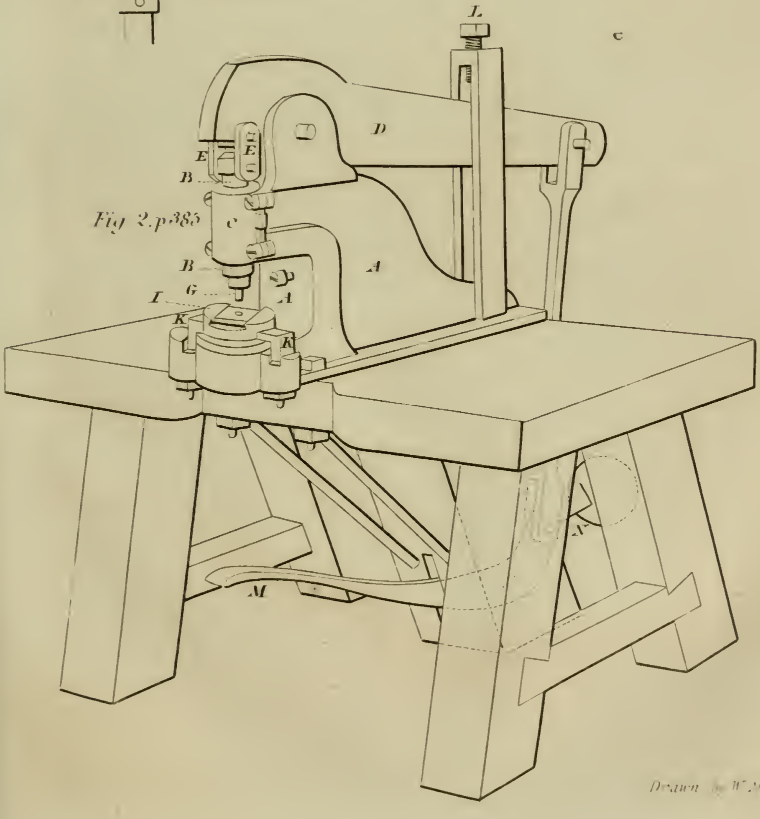


Fig 3.

Fig 2. p385



Drawn by W. Mason.

any apparent similarity, is the Rose engine, by which the beautiful ornamental work on the metallic dial plates, and cases of French and other watches, is performed. This instrument is only capable of *copying* patterns, previously formed upon "*guides*," whilst the Geometric lathe, forms its own patterns, which are all *original*, and are as various, and as unlimited in number, as those produced by the kaleidescope.

In the rose engine, the pattern is produced by a great number of distinct lines, separate from each other, whilst the figures formed by the Geometric lathe, result from one continued line, which returns into itself. When a die is to be formed, or an article to be ornamented, the tool (a single point) is at rest during the operation, whilst the lathe is made to revolve, and carries the article to be turned, in all the various circumvolutions, requisite to form the complete figure. Those who are acquainted with Suardi's Geometric pen, can form some idea how this may be accomplished. We have compared the lathe, in the multifarious patterns which it is capable of producing, to the kaleidescope, the justness of this comparison will be obvious from the fact, that the inventor of the lathe, is unable to re-produce a particular pattern, excepting he has kept an exact register of the arrangement by which it was originally produced; and that under any new arrangement, the resulting pattern is known from trial only.

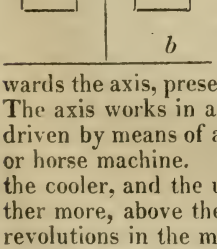
On carefully inspecting the specimen, it will be seen that on some of the figures, the lines are white, and the ground black, whilst on others, the reverse is the case: this is attained by what is called *transferring*; which bears some resemblance to the taking of an impression from a seal. When a steel die is made, the lines are cut in, like an engraving upon copper; this die is then hardened, and it is forced upon another piece of steel, with a power sufficient to produce a complete impression, so as to make a reversed die. By this means the effects produced, combine those of wood, and of copper-plate engraving, whilst the whole may be said to be mathematically correct, and defies the effort of the most skilful hand, to produce any thing like an exact imitation.

It has been said that what has been done by man, man may do again; to a certain extent this is true, but it is not absolutely so; who can reproduce a complicated form, which was the result of accident? the work of which we are now speaking, defies imitation as truly as that which is purely accidental. It is true that patterns may be produced which shall deceive unskilful observers; but this difficulty exists in the very nature of things; it is one thing to make an article which cannot be imitated, and another to create the power of discrimination, where nature has denied it, or where it has not been formed by habits of observation. We think that all that can be accomplished, in the prevention of counterfeiting, is to produce work requiring consummate skill, and expensive apparatus, so that a tolerable imitation, shall be equally difficult and unprofitable, whilst, to the discriminating, it may be absolutely inimitable. Is not this the case with the plan pursued by Messrs. Fairman, Draper, Underwood & Co? We think that this question may be answered in the affirmative.

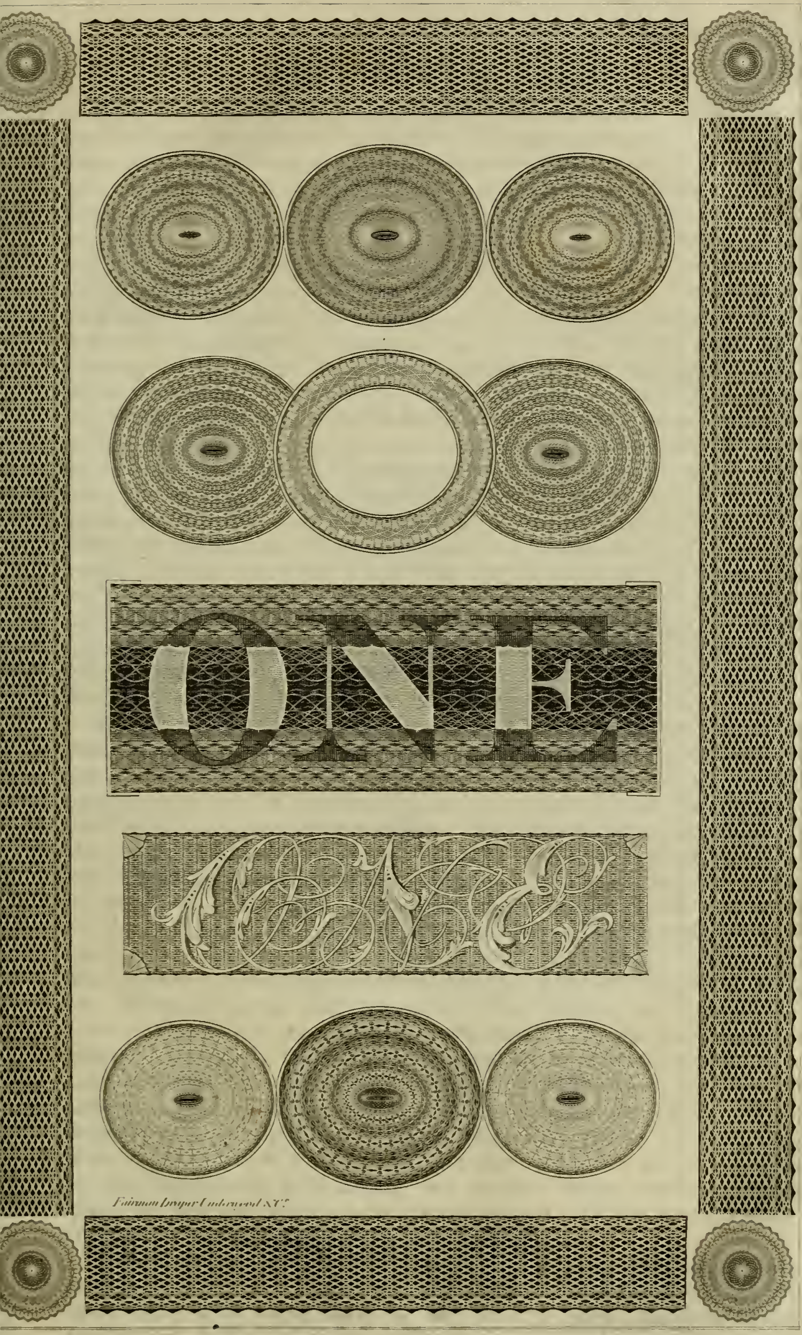
We have mentioned the subject of transferring, as applied to the lathe-work, but to this it is by no means confined. Every kind of engraving, but more particularly the vignettes, may be transferred by means of steel dies made in the form of rollers. The engravings are at first made upon cast-steel, which is afterwards hardened, an impression, in relief, is then taken upon cast-steel rollers, which are also hardened; from these the whole may be transferred to plates of copper, or of steel, so that impressions precisely similar, in every dot and line, may be made upon any number of plates, and these impressions, when worn, may be renewed by the same tool, with a precision which is otherwise unattainable. A degree of labour, may consequently be given to a single figure, which could not otherwise be afforded, and the first talents may be employed, at almost any price. The copper-plates, like the impressions upon paper, may be said to be printed.

An account of an improved method of cooling wort, in the operation of brewing.

One of the greatest improvements lately made in the process of brewing, consists in the introduction of Fanners, for the purpose of cooling the worts. The machinery alluded to, has been in use for many years in London, where it has nearly superseded the troublesome and expensive method of employing currents of water conveyed by pipes. It was, we believe, first introduced into Scotland about three years ago by Messrs. Berwicks, very skilful and extensive brewers in this city. From the patterns in their works, the machinery has been copied by other brewers, and is, we understand, getting into general use here; but as it is yet little known in many parts of Scotland, a short account of it may not be useless to our country readers.



The *Fanners*, or *Fans*, as they are familiarly called, are of the simplest construction. *a* is an upright iron axis, to which four plate iron leaves are attached at right angles, to the shaft, and to each other; two of these leaves, *c d*, are shown in the figure. The distance from the outer extremity of the leaf *c* to that of *d*, or the diameter of the circle which the *Fans* describe, is about six feet. The leaf, which is about 8 or 10 inches broad at the extremity, and a little narrower towards the axis, presents nearly a vertical plane, but is slightly twisted. The axis works in a socket resting on the floor of the cooler *b*, and is driven by means of a pinion at *a*, communicating with a steam engine or horse machine. The worts generally stand 4 or 5 inches deep in the cooler, and the under edge of the leaves is about an inch, or rather more, above them. The Fans, when in operation, perform 120 revolutions in the minute, and create a very powerful current of air, which sweeps like a tempest over the surface of the liquid.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ONE
Fairman Draper Underwood & Co.

Every brewer knows the importance of rapid cooling. The worts are let down into the cooler at the boiling temperature, and the stronger they are—and of course the more valuable—the more difficult is the process of refrigeration. How the atmosphere acts upon them chemists have not very well explained; probably it is through the agency of electricity. But it is well known, that the longer the worts stand exposed to the atmosphere, the more they become what brewers call *vapid;* that is to say, they lose more and more of their flavour, taste, and fermenting power; and in certain states of the atmosphere, within less than the compass of a natural day, they are rendered absolutely useless. Now a single fan of the dimensions we have described, placed in the centre of a cooler 25 feet square, will cool 30 barrels, or above 1000 imperial gallons of worts down to the required temperature (50 or 60) in *two hours.* But to cool the same quantity in the old way, by the natural action of the atmosphere, would have required, on an average, *ten hours;* and during this period the worts, which can now be drawn from the cooler with their strength and flavour not sensibly impaired, would have been deteriorated to the amount of some per cents. Hence the brewers hold that worts cannot be cooled too fast; and that every hour's delay beyond what is absolutely necessary, injures the quality, and lessens the value. We may judge, too, from this fact, of the importance of the fans. Indeed, we know that skilful brewers consider their introduction as the greatest improvement which the art of brewing has received for a long course of years.

Worts are cooled in consequence of the evaporation which takes place from their surface; and hence the advantage of spreading them out in a thin stratum. The passing of a current of air over the surface greatly increases the evaporation, and of course reduces the temperature with a corresponding rapidity. As brewers knew this long ago, it is singular that the simple process now employed to produce artificial refrigeration was not earlier adopted. It is not found that either in the quick or the slow evaporation, there is any loss of materials, for the air carries off water merely, and leaves the vegetable extract (as it leaves the salt of the ocean) without any sensible diminution, and in that state of inspissation to which the brewer desires to bring it. There is another fact connected with the process in which the results of practice, are found to correspond with the deductions of theory. We know that air absorbs moisture in proportion to its dryness, and that when previously saturated with humidity, its power to absorb, and of course its power to produce refrigeration, ceases. Hence brewers find, in opposition to vulgar ideas, that, however hot the weather be, provided it is clear, they are able, with the aid of the fans, to cool their worts with facility, but in very moist weather, though chill, the fans are found to be almost useless, and the process of refrigeration in any way, is extremely difficult.

Among other recent improvements in brewing, the use of iron coolers deserves to be noticed as one of great importance. They are more easily kept clean than the old ones of wood; they are better conductors, and assist more in effecting a rapid reduction of temperature in the liquid; but what is of still greater consequence, they do not, like those of wood, afford a lodgment in their pores, to acid matter which taints or injures the worts. [*Edinburgh Scotsman.*

On the Material used in Tuscany, for Plat. By Mr. WILLIAM SALISBURY.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

It appears that specimens of the straw, with seeds of the plant, were, in 1819, brought to this country by Captain Roper, R. N. and were presented by him to H. R. H. the Duke of Sussex, President of the Society. Some of these seeds his Royal Highness gave to Mr. Salisbury, who sowed and obtained a crop from them in the following year. The plants being allowed to come to maturity, proved to be the *triticum turgidum*, a variety of bearded wheat, which seems to differ in no respect from the spring wheat grown in the vale of Evesham, and in other parts of England.

In the autumn of 1823, M. Fournier, of Geneva, a friend of Mr. Salisbury, being about to make a journey to Florence, was requested to make enquiries for him respecting the culture and subsequent preparation of the bearded wheat, as far as regards its application to the purposes of platting.

M. Fournier states that the bearded wheat is cultivated largely in Tuscany, both for food as well as for platting; and that he saw the plant grown for its straw alone, in various parts of the Val d'Arno, between Pisa and Florence. The seed is thickly sown on a poor stony soil, on the bank of the river: when the crop is some inches high, it is mown, but not very close to the ground; this treatment subdues, more or less, the rankness of the plant, and the stems that shoot up are slenderer than before. If they are still too coarse, the crop is again mown, and so on to a third and even a fourth time, according to the vigour of the plant. When the stems are sufficiently fine, they are allowed to grow; after the bloom is over, but while the grain is still very milky, the plants are pulled up and exposed to the sun on the sand of the river, care being taken to water them from time to time. When the straw is come to a proper colour, a very careful selection is made of it, according to its quality, and it is divided into several sorts, according to the size of the straw. The only part used is from the base of the ear a few inches down towards the first joint. The part between the first and third joints is reserved for common plat.

Specimens of the straw in its unprepared and prepared states, collected by M. Fournier, and given by him to Mr. Salisbury, were laid before the committee.

On Ancient Vases.

(From the Latin of Professor Hausmann*.)

The ancient painted vases, chiefly dug up in many districts of Lower Italy, have excited much interest among the learned, and the admirers of ancient art. While the elegance and diversity of their forms, together with the singularity and boldness of their figures, delight the eye of the beholder, the variety of design and subject in the paintings with which they are decorated, equally conduce to the illustration of mythology, history, and ancient art. The investigation of these paintings has already contributed in no small degree to improve our knowledge of antiquity; nor has the imitation of the forms of those vases been less a source of profit as applied to the art of pottery. The famous Wedgwood-ware owes its celebrity as much to the successful imitation of the forms of those vases as to the excellence of its material. In like manner, the beautiful ornaments observed upon these vases, have, in our times, been transferred to the subjects of many other arts; and have been employed for the decoration of buildings, rooms, furniture, articles of dress, and other works of luxury; insomuch, that antique forms have become so common in modern art, that their origin has been nearly forgotten. Although ancient art has, in this manner, made its way into the shops of potters, and other artificers, and even into our drawing-rooms, yet the scientific study of technology, and the history of the mechanical and chemical arts, have hitherto been little advanced by the investigation of those ancient vases. In the writings of the ancients we scarcely find any passages in which positive mention is made of them; and none, in so far as I know, where their composition is spoken of. This point, therefore, can only be ascertained by an accurate examination of the vases themselves. During a journey which I made last year through Italy, I had opportunities of examining the splendid collections of those vases, which adorn the museums of Florence, Rome, and Naples. The pleasure derived from this investigation was much augmented by some observations which it suggested to me regarding their composition. The little that I have learned with regard to this subject, either during my journey, or from subsequent observations and experiments, I shall endeavour to expose in the following essay.

SECT. I.—*Of the Vases commonly called Etruscan.*

We shall confine ourselves to the vases commonly called Etruscan, although the greater part of them are not of Etruscan, but of Grecian origin. The celebrated Winkelmann was the first who refuted the opinion chiefly supported by Gorius and Buonarotti, that these painted vases of pottery-ware had been manufactured in ancient Etruria. But although it cannot be denied that the greatest quantity of vases has been dug up in those parts of Italy and Sicily which were formerly inhabited by the Greeks, nor that the style of their paintings, and their inscriptions, sufficiently demonstrate their Grecian origin, yet it is probable, that the art of fabricating painted vessels of earthenware, was not confined to that portion of Italy, but also extended to other districts, since, in many places remote from it, vases of the same general description have been dug up, which, however, possess so much diversity of character, with regard to their forms and paintings, as to induce the inference, that they had not been transmitted to those parts by commerce. Nor was this art confined to ancient Italy alone, but was also practised in Greece, and thence made its way into some of the neighbouring districts of Pontus. The painted vases found in these countries are essentially the same as those discovered in Italy.

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* Transactions of the Royal Society of Gottingen.

The vases found in different parts and situations of Italy differ more or less from each other, both with respect to the quality of the material, and to the workmanship and style of painting; the cause of which difference is to be sought for in the different natural qualities of the materials, or in a different degree of perfection in the art. For the art of forming vases of pottery-ware, and of ornamenting them with paintings, may not only have existed in various degrees of perfection in different places at the same time, but the state of this art had also, without doubt, been very different at different periods. And not only have earthen vases of very different degrees of fineness been manufactured at the same time and in the same places, but also plain vases, without any paintings, in all other essential respects agreeing with the painted ones, and destined for the same general purposes.

Of the painted earthen vases, dug up in different parts of Italy, those found in Lower Italy and Sicily are the finest. The best of all, however, are those found at Nola, both in respect to the excellence of their materials, and the elegance of their forms, together with the beauty of the paintings and the lustre of their varnish-like coating. Many of them are so perfectly preserved, that you might imagine them newly made. Next to the Nola vases, are those of Locria and Agrigentum. Many vases have also been found near Pæstum, the ancient Capua (now S. Maria di Capua,) Sancta Agatha Sothorum, Trebbia, Aversa, Avella, Tarentum, and in some other places of Apulia, and of the Neapolitan province named Abruzzo, the greater number of which are remarkable for their beauty. Of late years, vases have also been dug up in the vicinity of the cities of Angi, and Pomarico, in Calabria. The largest and best collection of vases, found in these and other places of Lower Italy and Sicily, arranged most elegantly and in the best order, is preserved in the Royal Museum of Naples; this collection has, of late, been much enlarged by the purchase of the extensive one made at Nola, belonging to the family of Vizenzio. Of the private collections at Naples, the most remarkable is that of the Archbishop of Tarentum, which is preserved at his seat near Portici, elegantly adorned with the choicest works of ancient and modern art; and what renders this collection still more deserving of attention is, that it is illustrated by a learned description drawn up by its accomplished proprietor himself. A great number of vases, dug up in Lower Italy, have also been deposited in the Vatican Library at Rome, and the public Museum of Florence.

In the middle part of Italy painted vases have been found much more rarely. In some places of ancient Etruria, as for example, near Voltena and the cities of Chiusi, Viterbo, and Corneto, a few were formerly dug up, some of which are preserved in the Florentine Museum. The true Etruscan vases may be distinguished from others by the inferior quality of their materials, by the dullness of their coating, but especially by the greater rudeness of their forms and painting, as well as by certain characters of the representations peculiar to the ancient Etruscan art. These differences may be very clearly seen in the Florentine Collection, where authentic Etruscan vases are placed in the same apartment with others of Grecian origin. In the great collection at Naples, I was shown only a single, mutilated, true Etruscan vase.

No vestiges of ancient painted vases have, in so far as I know, been found in Italy, to the north of the Appenines. Those which are preserved in the Museums of Bononia, Turin, and other cities of northern Italy, have migrated into those parts from southern Italy.

It is not my design in this treatise, to institute any inquiry into the periods at which these vases were manufactured, not only because investigations have already been made with respect to this point by many authors of great learning, but especially also because the settlement of it would involve an examination, entirely foreign to my views, of the various inscriptions observed on those vases, as well as of the subjects and characters of the paintings. It is undoubtedly more easy to discover the period up to which these vases may have been fabricated, than the time at which the art, commonly considered as of Grecian invention, but assuredly possessed of claims to a much higher antiquity, took its origin. It seems not improbable, that the latest period at which these vessels were manufactured in Italy, was the time of the civil wars. The Roman vases of later periods, dug up in many parts of Italy, as at Nola, Pompeii, and Rome, have a very different character. They have no paintings, but are frequently ornamented with raised figures, and usually have a red coating; characters which are also observed in the Roman vases dug up in some parts of Germany and France.

To a later period also belong the vases dug up in great quantity near Aretium, so far down as the time of Vasarius, many of which are preserved in the Florentine Museum. These vases have a red or blackish coating, and, in other respects, are of similar composition with the older Etruscan vases, with which they are sometimes confounded. It seems not improbable, that they belong to the Aretine vases, so highly esteemed in ancient times, which have been praised by Martial, and taken notice of by Pliny and Isidorus, although it is difficult to arrive at any certainty with regard to this point.

The painted earthen vessels of Grecian origin, which have been found in Lower Italy, seem to be of different ages. According to the opinion of the celebrated Millingen and some other antiquarians, an opinion which seems to be well grounded, the vases commonly, but incorrectly, called Egyptian, whose paintings are of a dusky red colour upon a yellow ground, in which condition some vases have also been dug up in Greece, are the most ancient. The vases, commonly called Sicilian, which have black paintings upon a reddish yellow ground, are, according to the same opinion, less ancient, but more so than the vases with reddish yellow figures and ornaments upon a black ground, which are the most common of all. This opinion has indeed been lately opposed by the celebrated Rossi, who has shown the vases with black figures, to be of the same age with the rest: his arguments, however, do not seem to invalidate the former opinion.

Many vases, either having no paintings at all, or, instead of figures, having other singular ornaments, have been dug up, both along with painted vases, and by themselves, not only in Lower Italy, but also in ancient Etruria, which have either the natural colour of burnt clay, or a black coating, or have been manufactured of clay evidently mixed with some black matter. The ornaments upon the black vases are very frequently of a white colour, sometimes yellow or red. Not only the forms, but also the colours, of the black coating and ornaments, as well as other circumstances, correspond with those which are observed in vases adorned with more perfect and more complex paintings; from which it may be supposed that these ruder, and less elegant vases, are of the same age and manufacture with those more beautiful productions of art, which, without doubt, were more highly esteemed in ancient, as they are in modern times.

The vases dug up in Lower Italy are found in Grecian sepulchres, more or less concealed beneath the surface of the ground, and constructed of stone in a rectangular form, placed near the remains of the dead body, and sometimes also suspended upon the walls; as is clearly shown by the excellent representations delineated by Knipius, added to Teischbein's plates of vases, as well as by the accurately executed models, exposed in the royal collection of vases at Naples. Many vases are also found in the same sepulchre, of various sizes and qualities. Some of these sepulchres, which are small, and constructed of rough stones, usually contain a smaller number of a coarser kind. In other sepulchres of larger size, constructed of hewn stones, and covered over with slabs like the roof of a house, some of which I have seen before the gates of the ancient Pæstum, vases of superior quality are found in great number. Sometimes they occur in their original position, and in a perfect state of preservation; at other times, however, they are crushed and destroyed. Some of them have retained in a surprising degree, their polish and original colours; others, especially those dug up in moist places, are slightly incrusted with a white calcareous substance, easily soluble in acids; this has probably been precipitated upon them from the water that had penetrated through the walls of the sepulchre. This preservation of vases, constructed at so remote a period, of such frail materials, and with so thin a coating, is a subject of much interest, and not less than the perfection of the art as practised by the ancients, invites to the investigation of their mode of formation.

We shall endeavour to distribute the most ancient earthenware vases, whether Greek or Etruscan, according to their mode of composition, into classes, for the purpose of obtaining a more distinct perception of their varieties.

(TO BE CONTINUED.)

An account of a new explosive engine, generating a power that may be substituted for that of the steam engine. By SAMUEL MOREY, of Oxford, New Hampshire.

TO PROFESSOR SILLIMAN.

Dear Sir,—Having accidentally discovered that the vapour of water and that of spirit of turpentine, when mixed with a very great proportion of atmospheric air, were highly explosive—I have been endeavouring to produce therefrom, a useful mechanical power; and embrace the earliest convenient opportunity to send you an account, and the result of some experiments. I should hope they may, at least in part, find a place in your Journal.

Alcohol may be substituted for water, or added to it in any proportion. The vapour, and atmospheric air, if placed in contact, will in time unite, as hydrogen gas and common air do, and become apparently as highly explosive. But the process by natural evaporation, would be too slow, when the use or demand was very considerable, unless the reservoir was very large, when it would then be inconvenient, expensive and unsafe. It was desirable to prepare or manufacture the article as wanted. In time it was effected. It was also very desirable, (and there was not, to me, any apparent reason why it might not be effected,) to command or control the explosions, as we do those of gunpowder, although they are much more violent. Another most desirable object, was, to unite in the same engine, if it possibly could be done, the effect or force of the explosion, with that of the vacuum, which always accompanies it: and that, without rendering it too complicated, expensive, and unsafe. By pursuing a course very analogous to that adopted for the use of gunpowder, it was in a measure, if not entirely, effected.

The preparing part of the machine consists of a metallic vessel, or tube, so constructed, that a stream or current of atmospheric air, may pass freely through it, together with the vapour or gas to be made use of; both being impelled through a space interrupted by short turns, or other impediments; the object of which is, to blend, mix, or unite them intimately with each other, by which process they are rendered highly explosive. This apparatus admits of an endless variety of forms. A description of one follows, which is found to be perfectly safe, and probably as convenient as any. Make a box of tin plates, four or five inches wide, and about fourteen long, and seven deep. Divide it horizontally, into four or five compartments, by partitions, which extend from one end of the box, to within a short distance of the other end, so that the air, entering the lower part, will be compelled, by the partitions, to travel the whole length of the box, through each compartment, in its ascent to the top;—divide these compartments, by vertical partitions, running the whole length of the box, except at the beginning, or where the air enters and passes out, into spaces, about half an inch apart, which have the double advantage, of effecting by their friction, a rapid mixture of the air and vapour with each other, and also of preventing violence in the explosion, should one take place in the box. A short tube for the admission of air and other materials into the lower apartment, and another for letting out the explosive, or prepared air from the upper one, each covered with fine wire gauze, to prevent explosion, will complete the preparing vessel. The opening to this box should be about two inches in diameter.

The exploding part of the machine, also admits of a great variety of construction. The following may serve as a convenient one. Have a cylinder fitted with a piston or plunger, and connected with a crank shaft, as in the steam engine, let the lower end of the cylinder have a valve of at least half its diameter, opening outwards. This valve may be made of thin soft leather, of the same diameter as the cylinder. This leather is to be tied or fastened to the lower end of the working cylinder, so as to form a continuation of the same. The lower end of the leather cylinder or valve, is to be flattened, so as to bring its inner sides together, for about four or five inches of its length, and kept in that position, by light springs attached to the two edges of the flat part, placing it in a position much like that of a bow, and bow-string. This valve is supported, or prevented from being driven into the cylinder, by a plate of metal, of sufficient thickness to bear the pressure of the atmosphere, arched or raised outwards, and perforated with as many holes as can be well made in it; the holes should be from about $\frac{1}{8}$ to $\frac{1}{4}$ an inch in diameter. The end of the cylinder forms the abutment to this arched plate. An air valve, also opening outward, is fixed in the side of the cylinder, just below the piston when down. A pipe from the preparing vessel, is inserted, or attached to the side of the cylinder, at from $\frac{1}{8}$ to $\frac{1}{4}$ of the length of the stroke from the top. This pipe should be as short as it can conveniently be, and it should be furnished with a valve next the preparing box, to cut off the communication with it, and a small valve about half an inch in diameter, next the cylinder, to let the inflammable air communicate with the flame of a lamp, so as to take fire, and communicate, by the trail, to the charge in the cylinder. These valves also open upwards, but as the explosion meets with so little resistance below, they are never thrown upwards. They, as is also the air valve, are worked by beams on the crank shaft, or by any other convenient mode. To give a double stroke, it will require two cylinders fitted up in this way, communicating with the same preparing vessel and crank shaft. When vapour is intended to be used, put a little alcohol, or high proof spirit, either alone, or with the addition of a small portion of spirit of turpentine, or put in spirit of turpentine and water, or other convenient materials, capable of evaporation, and the vapour of which is inflammable, when mixed with atmospheric air, into the lower apartment of the preparing vessel; the proportion of each is not very material. Apply a small lamp, or other heating substance, to raise the temperature to about blood heat, and place the flame of a lamp, at the inflaming valve. The piston being down, in its ascent would form a vacuum under it; this is prevented by opening the air valve which supplies the cylinder with common air, until the piston reaches the pipe from the preparing vessel. It then closes, and the vapour valve supplies the remainder of the cylinder, through the preparing vessel, with the explosive air, and just before the piston is up, say about $\frac{1}{8}$ of an inch, the vapour valve closes at the same time that the inflaming valve opens and shuts, the piston being then still rising, draws or turns the flame of the lamp at the firing valve, through the opening into the pipe, inflames the trail, and it is instantly communicated to the charge in the cylinder; the explosion that ensues, drives out the air from within the cylinder, through the perforated arched plate and leather valve at bottom, which valve instantly collapses and prevents the return of the air. The steam, formed by the explosion and formation of the vacuum, is condensed, by keeping the lower part of the cylinder cool, by surrounding it with water, and suffering the vacuum to inject a small stream of cold water near the bottom—which also keeps the arched plate, and leather valve, cool. A vacuum under the piston, instantly follows the explosion, which descends by the pressure of the atmosphere, and carries the crank with it, while the same process is repeated in the second cylinder, and the power is taken from the crank-shaft, or piston-rod, as in the steam-engine. When the temperature is low, smaller charges will produce the same effect, if a thin metallic plate of the same diameter as the piston, be introduced into the cylinder, called the charging piston. It is fitted with a small rod, which moves through a stuffing-box in the main piston, so tight, that the friction will support its weight. This charging-piston is prevented from rising higher than the vapour-pipe, by its end striking against a stationary point, in its ascent, and forming a partition between the compound air in the cylinder, and the common atmospheric air, thereby preventing so great a mixture of atmospheric air in the cylinder, as to lessen the effect of the explosion.

When the temperature of the box is so high as to give off too great a proportion of vapour, the engine works better, by stopping entirely the working of the charging piston, but not with so good economy. This charging piston should be fully perforated with small holes, lest by accident it should not rise with the working piston, as well as to let the explosion pass freely through it, to clear the cylinder. Wire gauze should also be placed between the vapour and inflaming valve, to prevent explosion in the box, should the vapour valve not close in time. When hydrogen gas is intended to be used, an apparatus similar to Professor Hare's compound blow-pipe, may be attached to the engine, to throw the air and gas into the preparing box.

A box of the form and size before mentioned, appears to be sufficient to prepare air fast enough, with a small lamp, to furnish from fifty to one hundred charges per minute, for a cylinder of seven or eight inches in diameter, having a two foot stroke, the box being in use only one quarter part of the time; it, of course, would supply four such cylinders if the air was constantly blown or drawn through it. To keep up the temperature of the box, would, in that case, probably require more heat, but it does appear, that the more rapidly the air is made to pass over the liquors, the more rapidly it takes up vapour at the same temperature.

The following, are some of the methods, I have successfully adopted, in producing a power from this same source.

I have caused the air, by the effect of the explosion, to be compressed over a column of water, to such a degree, as to throw it to a great height and distance.

I have, in a measure, reversed it, and by forming a vacuum in a vessel above, the water would be driven up, by the pressure of the atmosphere.

I have caused the explosion to compress, in a reservoir, a quantity of atmospheric air, and made use of that compressed air, for working an engine, similar to a double stroke high pressure steam engine.

This mode will make it perfectly safe on account of fire, as the compressed air may be led, in tubes, any distance, before it works the engine.

Sometimes I have made a valve in the piston to open upwards, and fill the cylinder below the piston with the prepared air, and when the piston is about half way up the cylinder, it is at the height of its working stroke; the explosion then takes place. The effect is, that the quantity of air above the piston is nearly doubled; its elasticity or force is also greatly increased, by a great increase of its temperature, it now re-acts on the piston, while a vacuum below, adds greatly to the effect. This mode acts with great energy in a small space.

I have attached to the working piston, thin tubes, about $\frac{3}{8}$ of an inch in diameter, open at top, each one of which is directly over and enters one of the tubes of a condenser, attached to the bottom of the cylinder, which tubes are $\frac{3}{4}$ of an inch in diameter. The prepared air, as usual, is let into the cylinder near the upper end; as the piston rises, it fills with the prepared air, the upper part of the tubes, and the spaces around them, and when the piston is nearly up, the explosion takes effect, but the tubes prevent all violence.

At, or near all of those springs, which are constantly giving off hydrogen gas, engines may be erected (substituting the gas for that of the vapour of the liquors) to work constantly, for every desired mechanical purpose. The engines can be placed in any chosen situation, by only conducting the gas through tubes, and if desired, the air and gas may pass in due proportion through the tubes together, which, with a few short turns, will insure its suitable preparation, although the distance should be short.

The explosive vapour engines will work without any fire, when the temperature of the weather, in the sun or in the shade, is about 80 or 90°, provided the charge be inflamed by the electric spark. With a due proportion of ether, according to the temperature of the weather, it is probable that the engine will work at any time, with only a lamp to inflame the charge.

The less is the proportion of alcohol the higher temperature will be required. So again, the more turns, back and forth, the air makes in contact with the liquor, in the box, the lower temperature will be required to prepare it. If the temperature of the box gets down to about 70°, the spirit of turpentine refuses to come over at all, or at least, in sufficient quantity to give energy to the explosion. I have lately substituted a plunger, in lieu of the piston, and attach the stuffing to the top of the cylinder; it works well, and is more convenient. A small bellows is convenient in putting the engine in motion, or the explosive air may be blown into the cylinder, and inflamed, to warm it, and commence the operation.

A very easy mode, to try an experiment, for the purpose of preparing this explosive air mechanically, is to have made a few feet of inch tubes, of common tin plate. These tubes should be turned, once in about a foot, at right angles, and the long part should be filled with small tubes, about ¼ of an inch in diameter. If air is made to pass through this crooked tube, while it contains a single spoonful of high proof whiskey, and spirit of turpentine, with a proper temperature, it comes out highly explosive, if the current is forced through by a hand bellows, with ever so much velocity. As we now construct the engine and preparing vessel, it is impossible that an explosion can take place, that will injure any one. A few drops of these liquors, on a board in the sun, with a tumbler inverted over them, will explode in a short time, if a flame is applied.

It will not, I trust, appear surprising, that these improvements are patented.

I am, dear Sir, yours, most respectfully,

Samuel Morey.

P. S.—I am sensible, that a drawing ought to accompany this paper, but at present, it is out of my power to furnish one.

[*Silliman's Journal.*

A method of Preserving Lime-Juice. By Captain T. M. Bagnold.

From the Transactions of the Society for the encouragement of Arts, Manufactures and Commerce.

It is well known that the Juice of lemons, or of limes, expressed from the fruit, will in a short time, especially if kept warm, become mouldy, and unfit for use as an article of food; and that the final result of this spontaneous change is the destruction of the acid itself. The acid may, indeed, be separated from the other matters with which it is naturally mixed; but in so doing all the odour and flavour of the native juice are also destroyed, for pure crystallized citric acid is wholly inodorous, and to the taste simply acid.

The effect of pure citric acid, in preventing or mitigating the severity of sea-scurvy, is greatly inferior to the recent juice; and in many of our circumnavigations, lemon or lime-juice, mixed with a small proportion of rum, about one-tenth, has been found to keep for a considerable time in tropical countries, and to be very efficacious in preserving the health of the crews. In some cases, however, this addition of spirit is by no means desirable.

In April, 1824, Captain Bagnold produced to the committee a specimen of lime-juice, which had been prepared in Jamaica in the preceding September, according to his directions. The juice having been expressed from the fruit, was strained, and put into quart bottles: these having been carefully corked, were put into a pan of cold water, which was then by degrees raised to the boiling point. At that temperature it was kept for half an hour, and was then allowed to cool down to the temperature of the air. The process, therefore, was, in substance, only the same as that which has been long practised in this country, for preserving green gooseberries, and other fruits, for domestic use. A bottle being opened by the committee, the juice was in the state of a whitish, turbid liquor, with the acidity, and much of the flavour of the lime; nor did it appear to have undergone any alteration.

In March, 1825, some of the same juice, which had been examined the year before, and which had since only been again heated, and carefully bottled, was laid before the committee. It was still in good condition, retaining much of the flavour of the recent juice.

Hence, it appears, that by the application of the above process, the addition of rum, or other spirit, to lime or lemon juice, may be avoided, without rendering it at all more liable to spontaneous alteration.

On the Cohesive Strength of Different Metals.

FROM YOUNG'S NATURAL PHILOSOPHY.

We shall take for the measure of cohesion, the number of pounds avoirdupois, which are just sufficient to tear asunder a rod, or bundle, of one inch square. From this it will be easy to compute the strength, corresponding to any other dimension.

“ 1ST METALS.

		lbs.
Gold cast		20,000 24,000
Silver cast		40,000 43,000
Copper cast	Japan	19,500
	Barbary	22,000
	Hungary	31,000
	Anglesea	34,000
	Sweden	37,000
Iron cast		42,000 59,000
Iron bar	Ordinary,	68,000
	Stirian,	75,000
	Best Swedish and Russian,	84,000
	Horse nails,	71,000
Steel bar	Soft,	120,000
	Razor temper,	150,000
Tin cast	Malacca,	3,100
	Banca,	3,600
	Block,	3,800
	English block,	5,200
	——— grain,	6,500

	lbs.
Lead cast	860
Regulus of Antimony	1,000
Zinc	2,600
Bismuth	2,900

2ND, OF WOODS, &C.

The only author who has put it in our power to judge of the propriety of his experiments, is Muschenbroëk. He has described his method of trial, minutely, and it seems unexceptionable. The woods were all formed into slips fit for his apparatus, and part of the slip was cut away to a parallelopiped of $\frac{1}{5}$ of an inch square, and therefore $\frac{1}{25}$ of a square inch in section. The absolute strengths of a square inch were as follow.

	lbs.		lbs.
Locus tree	20,100	Pomegranate	9,750
Jujeb	18,500	Lemon	9,250
Beech Oak	17,300	Tamarind	8,750
Orange	15,500	Fir	8,330
Alder	13,900	Walnut	8,130
Elm	13,200	Pitch Pine	7,640
Mulberry	12,500	Quince	6,750
Willow	12,500	Cypress	6,000
Ash	12,000	Poplar	5,500
Plum	11,800	Cedar	4,880
Elder	10,000		

Mr. Muschenbroëk has given a very minute detail, of experiments on the ash, and the walnut; stating the weights which were required to tear asunder slips taken from the four sides of the tree, and on each side, in a regular progression from the centre, to the circumference. The numbers of this table corresponding to these two timbers, may therefore be considered as the average of more than 50 trials made of each, and he says that all the others were made with the same care. We cannot therefore see any reason for not confiding in the results; yet they are considerably higher than those given by some other writers. Mr. Pitot says, on the authority of his own experiments, and of those of Mr. Parent, that 60 pounds will just tear asunder a square line of sound oak, and that it will bear 50 with safety. This gives 8640 for the utmost strength of a square inch, which is much inferior to Muschenbroëk's valuation.

We may add to these

	cwt.
Ivory	16,280
Bone	5,250
Horn	8,750
Whalebone	7,500
Tooth of sea calf	4,075

The reader will surely observe that these numbers express something more than the utmost cohesion, for the weights are such as will very quickly, that is, in a minute or two, tear the rods asunder. It may be said in general that two-thirds of these weights will sensibly impair the strength after a considerable while; and that one half, is the utmost that can remain suspended at them, without risk, for ever; and it is this last allotment that the engineer should reckon upon, in his constructions. There is however a considerable difference in this respect. Woods of a very straight fibre, such as fir, will be less impaired by any load which is not sufficient to break them immediately.

According to Mr. Emerson, the load which may be safely suspended to an inch square, is as follows:

	lbs.
Iron	76,400
Brass	35,600
Hempen rope	19,600
Ivory	15,700
Oak, box, yew, plum-tree	7,850
Elm, ash, beech	6,070
Walnut, plum	5,360
Red fir, holly, elder, plane, crab	5,000
Cherry, hazle	4,760
Alder, asp, birch, willows	4,290
Lead	430
Freestone	91

He gives us a practical rule, that a cylinder, whose diameter is *d* inches, loaded to one-fourth of its absolute strength, will carry as follows:

	cwt.
Iron	135
Good rope	22
Oak	14
Fir	9

The rank which the different woods hold in this list of Mr. Emerson's, is very different from what we find in Muschenbroëk's. But precise measures must not be expected in this matter. It is wonderful, that in a matter of such unquestionable importance, the public has not enabled some persons of judgment, to make proper trials. They are beyond the abilities of private persons.

Mr. Banks takes iron, at an average, to be four times as strong as oak, and 5½ times as strong as deal or fir.

According to the experiments of various authors, the cohesive strength of a square inch of razor steel, is about 150,000 pounds; of soft steel, 120, of wrought iron 80, of cast iron 50, of good rope 20, of oak, beech, and willow wood, in the direction of their fibres, 12, of fir 8, and of lead about 3,000 pounds; the cohesive strength of a square inch of brick 300, and of free stone 200; teak wood, the tectona grandis, is said to be still stronger than oak.

The strength of different materials in resisting compression, is liable to great variation. In steel, and in willow wood, the cohesive, and repulsive strength, appear to be nearly equal. Oak, will suspend much more than fir; but fir, will support twice as much as oak, probably on account of the curvature of the fibres of oak. Freestone has been found to support about 2000 pounds, for each square inch; oak, in some practical cases, more than 4000.

The strongest wood of each tree, is neither at the centre, nor at the circumference, but in the middle between both; and in Europe it is generally thicker and firmer on the south-east side of the tree. Although iron is much stronger than wood, yet it is more liable to accidental imperfections; and when it fails, it gives no warning of its approaching fracture. The equable equality of steel may be ascertained by corrosion in an acid, but there is no easy mode of detecting internal flaws in a bar of iron, and we can only rely on the honesty of the workmen for its soundness. Wood, when it is crippled, complains, or emits a sound, and after this, although it is much weakened, it may still retain strength enough to be of service.

On Bronzing Brass Goods.

The first thing to be attended to in this art, is the preparation of the bronze to be used. Many receipts have been given for preparing this, but the two following we think decidedly the cheapest, and the best we have seen.

Receipt for making Green Bronze.

Take one quart of strong vinegar; half an ounce of mineral green; half an ounce of raw umber; half an ounce of sal ammoniac; half an ounce of gum arabic; two ounces of French berries; half an ounce of copperas; and about three ounces of green oats, if these can be procured; although, if they cannot, the preparation will succeed perfectly well without them. Dissolve the different salts, and gums, in small portions of the vinegar; then mix the whole in a strong earthen vessel, adding the berries and the oats, over a gentle fire: bring the compound to boil. Then allow it to cool, and filter it through a flannel bag, when the bronze will be fit for use.

Receipt for making Bronze commonly used by Brass-founders.

Take one English pint of strong vinegar; one ounce of sal ammoniac; half an ounce of alum; a quarter of an ounce of arsenic: dissolve them in the vinegar, and the compound is fit for use. This bronze frequently answers perfectly well when the vinegar and sal ammoniac alone are used. We know brass-founders who have been in the habit of using this cheap composition for several years; and, where the metal is good, it is very seldom found to fail.

The bronze being now prepared, the next thing to be attended to is the cleaning of the brass-work, to be bronzed; and the best method for

Cleaning work previous to using Bronze,

Is either by filing, turning, rubbing with sand-paper, or dipping in aqua-fortis. It is absolutely necessary, in order to be successful, to have the work well cleaned, and free from grease, especially; and the latter of these methods is certainly the best, and therefore ought always to be used when it is wished to succeed particularly well, although any of the above methods are perfectly sufficient for ordinary purposes.

Having thus got the bronze and the work ready, we now proceed to describe the manner

Of Bronzing.

This must be done with a small brush, and great care must be taken to keep the work constantly wet with the liquid, to prevent it turning green. When the colour which is wished has been attained, which will generally be in from twenty to thirty minutes, the work must be quickly washed in clean cold water, and then dried in soft warm sawdust, after which the whole is laid over with a coating of lacker, which preserves the colours.

It often happens, however, from the quality of the brass, that the bronze will not bring the work to a sufficiently dark colour; means must be used to remedy this defect, and we think

The best and cheapest method of giving the proper dark tinge to Bronze,

When, from the nature of the metal, we cannot otherwise succeed, is the following. Mix about a quarter of an ounce of the finest lamp black, with about one gill of strong spirit of wine, and strain the mixture through a fine linen cloth. The work on which the bronze has been already used, must then be warmed upon a cistern plate, or over a clear fire, until it can scarcely be held in the hand. Then, with a fine camel hair brush, such as is used for lackering, the work must be laid over with this mixture, in very thin coatings, until the shade required, be obtained. When cold, it must be polished with a very soft brush, or piece of linen rag, dipped or moistened with clear green oil. A coating of lacker is then laid over the whole, and the most beautiful bronze will be obtained that can be produced on brass; and, if the work is not made too black with the mixture, nor the lacker used of too bright a yellow, the bronze obtained, will be a beautiful dark green —the colour now so much used by the English brass-founders. By this it will be seen, that any shade of what is called green bronze can be obtained, simply by using more or less of the blacking, and a lighter or darker colour of the yellow lacker; and the different tints wished to be given to the work will of course be obtained by the different thickness of the coatings of blacking which the several parts of the work receive. The work, however, will stand much longer in colour, when the bronze can be made sufficiently dark, without using the blacking at all; and this can be done, although it takes longer time than is required when the blacking is used.

Method of giving the Bronze the proper shade without using the Blacking.

When either of the bronzes, first described, have been used, and the work dried, as there described, if the shade should not appear so dark as is wished, let the work be placed before a smart fire, or in bright sunshine, where, however, no current of air passes. When thus exposed, let it be turned occasionally, and brushed with a soft brush. This plan will be found to produce a very fine bronze, after all other means have failed, (with the exception of the blacking) but it is tedious, and where time is an object, it will always be found best to use the blacking.

We are aware that many other receipts for making bronze are to be met with; but those we have given, are decidedly the best, and cheapest, used, and are the best fitted for practical people. In our next we shall give some equally cheap receipts for making lackers, with practical observations on lackering.

Remarks by the Editor. The foregoing article is copied from the Glasgow Mechanics' Magazine, and upon the credit of that valuable work, it is inserted; the Editor has not tested the processes, but it is his design so to do; when the result shall be made known. The object of bronzing, is to give to articles an appearance similar to that which statues, &c., made of the alloy called bronze, acquire by age. The manner of effecting this on wood, and on plaster casts, differs essentially from that above described, and shall be given in our next number. The liquid by which brass is bronzed, corrodes its surface; figures of plaster of Paris, or of wood, are coated, as with paint.

Improvement in Steam Vessels.

There is said to be a contrivance now employed on board a Scottish steam vessel, which might be used to great advantage to other vessels, of a similar kind. By the simple motion of a small handle or index, placed on a table upon deck, in view of the man at the helm, and of the master of the vessel, every movement which the engine is capable of giving to the paddle wheel may be at once commanded. The vessel may be moved backwards or forwards, or may be entirely stopped at any given movement by merely turning the handle to the place denoted by the gradations of a dial plate. No skill is required for this purpose; the master himself, or a sailor under his direction, can perform the office, as well as the ablest engineer. Thus the confusion which frequently arises at night, in calling to the engineer, is avoided, and any ambiguity, arising from the word of command being transmitted through several persons, avoided, (circumstances which may lead to the most serious accidents.) The engine is by this contrivance, as much under command, as the rudder.

Economical Refrigerator for cooling Water.

Mr. Meer of this city, has invented a very economical apparatus, for containing water, and reducing its temperature, on the principle of evaporation. It is formed of burnt clay, composed as follows; about one part of common red potter's clay, and three parts of micaceous clay of an open texture: it is made in the form of a cylindric jar, and holds about six gallons; a hole is formed near the bottom, to admit a cock or spigot. This jar is placed on three cubes of wood, in a glazed pan of brown earthenware, made to receive any water, which exudes from the porous sides and bottom of the jar, should more pass than is carried off by evaporation. In the inside of the jar, is placed a narrow earthen vessel, nearly long enough to touch the bottom, and suspended from the top, by its rim; this is to contain ice, when it is required, to render the water extremely cold. By this contrivance the ice remains long in the solid state, and does not, when melted, mix with the water in the jar, to render it foul, or otherwise unpleasant, whilst not half the quantity is required, as in the common practice.

This simple and cheap apparatus, will be found to be very useful, for public or private houses: one in complete operation may be seen at No. 4, south Seventh street, opposite the Franklin Institute, where the curious are invited to examine it.

They can be had at Messrs. Headman's Pottery, No. 17, south Eighth street. J. M.

Notice of Nicholson's Operative Mechanic.

We have, in some of our former numbers, made some extracts from the miscellaneous part of NICHOLSON'S OPERATIVE MECHANIC, and have spoken of the work in terms of approbation. An improved edition of this book, has just issued from the press of Messrs. Carey & Lea, of this city. The compiler, Mr. John Nicholson, is the son of the late William Nicholson, whose Philosophical Journal, and other valuable scientific works, are well known. The volumes before us, are an interesting compend, of the most important arts and manufactures of Great Britain. Most of the articles, are selected from larger, and more general works, rarely accessible to those engaged in manufactures: the work contains also, a considerable portion of matter, supplied by those engaged in the various operations of which it treats, and by the observation and experience of Mr. Nicholson himself, in several of the manufactories. "A Book comprehensive and practical, embracing the whole subject, as living and contemporaneous, and as connected with private profit, and public glory, instructive to individuals, and illustrative of the genius of the age, in its best direction, has been the object of the Author," and we think he has not laboured in vain.

From a very reprehensible oversight in the English edition, numerous letters of reference, which were found in the text, had not been inserted on the plates; in the edition of Messrs. Carey & Lea, this has been carefully attended to, *many hundred* omissions of this kind, having been supplied. There are also several additional copperplates, illustrating some of the most important American inventions, of which descriptions are given. The two plates in our present number, are a part of them, the others represent the forcing pump, &c. at the Fair-mount water works, fire-engines, mill work, printing press, lathe, &c.

There are but few mechanics, and manufacturers, to whom this work will not supply useful information; whilst to the general reader, who is fond of mechanical pursuits, it will give a more comprehensive and interesting view of the subjects upon which it treats, than is to be found in any other single publication.

List of New Patents, in England, which have passed the Great Seal, since April 18, 1826.

John Billingham, civil engineer, for an improvement, or improvements, in the construction of Cookery apparatus. Dated April 18, 1826.

James Kowbotham, and Robert Lloyd, for a method of preparing, forming, uniting, combining, and putting together, certain materials, substances, or things for the purpose of being made into hats, caps, bonnets, cloaks, coats, trowsers, and for wearing apparel in general, and various other purposes. Dated April 18, 1826.

To William Wood, for an Apparatus for destroying the Inflammable air (which is commonly known by the name of Fire-damp) in Mines. Dated April 22, 1826.—To be specified in six months.

To John Petty Gillespie, for a new Spring, or combination of Springs, for the purpose of forming an Elastic Resisting Medium. Dated April 25, 1826.—In six months.

To Samuel Brown, for certain improvements on his former patent. Dated December 4, 1823, for an Engine, or instrument, for effecting a Vacuum, and thus producing powers by which Water may be raised and Machinery put in motion. Dated April 25, 1826.—In six months.

To Francis Halliday, for an apparatus or machine for preventing the inconvenience arising from Smoke in Chimneys, which he denominates a Wind-guard. Dated April 25, 1826.—In six months.

To John Williams, for certain improvements on Ships' Hearths, and apparatus for Cooking by Steam. Dated April 27, 1826.—In two months.

To William Choice, and Robert Gibson, for certain improvements in machinery for making Bricks. Dated April 27, 1826.—In two months.

To Charles Kennedy, for certain improvements in the Apparatus used for Cupping. Dated April 29, 1826.—In six months.

To John Goulding, for certain improvements in the Machines used for carding, slubbing, slivering, roving, or spinning, Wool, Cotton, waste Silk, short stapled Hemp and Flax, or any other fibrous materials or mixtures thereof. Dated May 2, 1826.—In six months.

To Arnold Buffum, late of Massachusetts, in the United States of America, but now residing in the city of London, (being one of the people called Quakers,) and John M'Curdy, who, in consequence of communications made to them by a certain foreigner, residing abroad, and discoveries made by themselves, are in possession of an invention of improvements in Steam Engines. Dated May 6, 1826.—In six months.

To Sir Robert Seppings, for certain improvements in the construction of Fids, or apparatus for striking Top-masts and Top-gallant-masts in Ships. Dated May 6, 1826.—In six months.

To William Fenner, for an improvement in machinery or apparatus for curing smoky, and cleansing foul Chimneys. Dated May 6, 1826.—In six months.

To Alexander Allard de la Court, for a new instrument and improvements in certain well known instruments applicable to the Organ of Sight. Dated May 6, 1826.—In six months.

To Joseph Schaller, for certain improvements in the construction or manufacture of Clogs, Pattens, or substitutes for the same. Dated May 6, 1826.—In six months.

To Edward Heard, for a certain new composition or compositions to be used for the purpose of washing in Sea and other Water. Dated May 8, 1826.—In six months.

To Levy Zachariah, jun., for a combination of materials to be used as Fuel. Dated May 8, 1826.—In six months.

List of Patents issued in the United States, from the 8*th to the* 19*th of June,* 1826.

Improvement in the construction of Chimneys, June 8, Abraham G. D. Tuthill, Utica, Oneida Cy., New York.

In the turning lathe, June 8, John Hunt, Shutesbury, Massachusetts.

In Grist Mills, June 9, Francis Harris & John Wilson, Troy, New York.

In the mode of taking the cotton from the doffer, June 9, Elijah Thompson, Lowell, Massachusetts.

In the machine for making boots and shoes, June 9, Elijah Thayer, Leicester, Massachusetts.

In the machine for moulding bricks and tile, June 9, Ezra Fisk, Fayette, Maine.

In the Machine for roping and spinning cotton, June 10, William Carmichael, Sand Lake, New York.

In the rolling or twisting roving of cotton, June 14, William Whitehead, jr. Paterson, New Jersey.

In the instrument for operating for the cancer, June 14, Thomas R. Williams, Philadelphia.

In Paul Pillsbury's machine for shelling corn, June 15, Jeremiah Dodson, Guilford, North Carolina.

In the Loom, June 14, Cornelius Bergen, New York.

In the mode of emptying the well bucket, June 15, Elijah Willard, Egremont Massachusetts.

In the machine for spinning wool, tow, &c. June 15, John Corrill & William P. Rogers, Harpersfield, Ohio.

In the machine for drawing canal boats for repair, June 16, Seth C. Jones, Rochester, New York.

In the percussion lock, for rifles, muskets, &c. June 16, Joseph Medbery & Silvester Kellogg, Rochester, New York.

In the mode of applying water to water wheels, June 19, D. M'Kenzie, M. L. Barber, S. Dean, and John C. Narlghton, Caledonia, New York.

In the machine for bending tire for wheels, June 19, Walter Janes, Ashford, Connecticut.

In the machine for weighing canal boats, June 20, Benjamin Bull, New York.

The article headed "FRENCH PATENT," was by mistake of the printer, placed among the English Patents; it was intended to have followed them.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS,
AND GENERAL SCIENCE.

SEPTEMBER, 1826.

FOR THE FRANKLIN JOURNAL.

Specification of certain improvements in the Locomotive Engine, and in the mode of transferring loaded carriages from one level to another, in their passage upon rail-ways. By S. H. Long, *Major of Topographical Engineers. With four copper-plate engravings.*

[FILED IN THE UNITED STATES PATENT OFFICE.]

The Locomotive Engine in present use, is applied only to the propelling of loaded carriages upon horizontal rail-ways, or such as have a slight inclination only. In situations where a transition is to be effected from one level to another, Inclined Planes are interposed between the different horizontal sections of the rail-road, and the transfer is usually effected by means of these and stationary Steam Engines, or other stationary machinery; the Locomotive Engine as hitherto employed, being inadequate to this purpose. The improvements under consideration, provide for the transfer of loaded carriages, both ascending and descending, by means of the Locomotive Engine, independently of any aid from extraneous powers. The manner of accomplishing these objects will be explained under three distinct heads, to be denominated the first, second, and third, methods.

FIRST METHOD.

The machinery contemplated in connexion with this method, consists of the following variations and additions, in the construction of the Locomotive Engine and its rail-way, viz.

1st. The axles of the carriage-wheels of the engine, must be constructed in a manner to admit of their revolving, both in bearings or steps attached to the carriage frame, and in the hubs or naves of their respective wheels.

2nd. Cranks to receive the action of the steam engine, must be firmly attached to the ends of the axles.

3d. Ratchet wheels must be firmly attached to the outer ends of the hubs of the carriage-wheels, to be acted upon by ratchets, applied to the cranks.

4th. A pinion is to be added to each axle, and is to act upon a rack, or toothed rail, located mid-way of the rail-track, of each inclined plane.

These several modifications in the construction of the engine, and its rail-way, will be more fully explained in the following

REFERENCES TO THE DRAWINGS.

Fig. 1. A view of the ratchet wheel, and ratchet, with their adjustments. AA, The ratchet wheel attached to the outer end of the hub, as represented at *aa*.

B, The ratchet, traversing upon the wrist of the crank, and connected to the spring *cc*, by means of the part *b*, and the connecting rod *bc*.

C, The crank, the wrist of which passes through it, and serves also as a pivot for the ratchet B. The spring *cc*, is attached to the crank, by means of screws near to its inner, or butt-end.

D, The trigger, serving as a prop to sustain the ratchet, when out of gear: *n*, a pintle, passing through the ratchet B, the outer end of which plies in the slit of the trigger D, while the inner end serves as a knob or spanner, whereby to lift the ratchet out of gear.

Fig. 2. A view of the washer, situated between the crank and the hub, or ratchet wheel, together with the trigger attached to it.

D, The washer and trigger connected. *d*, A spring upon the outside of the trigger, serving to confine the pintle (*n*, fig. 1) when at the end of the slit.

N. B. The trigger, instead of being connected with the washer, may be attached to any convenient part of the crank, in a manner to admit of the requisite oscillatory movements.

Fig. 3. A view of the carriage of the Locomotive Engine, together with its pinions, and the rack or toothed rail.

A, The carriage wheels.

a, The ratchet wheels, as represented at A, fig. 1.

B, The axles of the carriage, traversing in bearings attached to the carriage frame; as also in the hubs of the carriage wheels, as the occasion may require.

C, The cranks firmly attached to the outer ends of the axles, and separated from the ratchet wheels by washers, as before intimated. *b* and *c*, The same as in fig. 1.

D, The pinions or small cog-wheels, mid-way of the axles, to be employed in the passage of inclined planes.

E, Cog or toothed wheels, for the reception of the endless-chain *e*.

F, A sort of compound axle tree, furnished with bearings for the axles, and constituting a part of the carriage frame or bed.

G, A portion of the toothed rail or rack, located within the rail-track, and adapted to the reception of the pinions D.

N. B. The extent of the rack along the rail-way, should be such as to embrace the whole length of the inclined plane; and in addition thereto, should occupy a space at each end of the plane, equal in extent to that occupied by an entire train of carriages.

In case the inclination of a plane should be too great for the ascent of a Locomotive Engine, with its entire train of carriages at once, it is proposed to arrange the carriages partly in front, and partly in rear of the engine, that one half, instead of the whole load, may be raised at a time. In this case, the steam engine must be furnished with apparatus to reverse the movements of the steam valves, so that the Locomotive Engine, after having ascended with half its load, may return *backwards* for the other half.

The action of the Locomotive Engine may be greatly increased, in the following manner, viz. Let a cog-wheel, of as large a size as the situation will admit, be located vertically between the two chain wheels, so as to receive the action of the endless-chain, both above and below; and let a pinion be attached to its axis, and ply into the toothed rail of the rail track, as before; and the power or action may be increased to any desirable extent.

As a means of preventing the too rapid descent of the Locomotive Engine, and train, in their passage down an inclined plane, the following expedients are suggested, with the belief that they never have been resorted to on any similar occasions, viz.

1st. Let the throttle valve be closed, and the steam engine allowed to labour without a supply of steam. In this case, the movements of the piston will be counteracted by a force equal to one atmosphere on its area, which will probably operate as a check, sufficient for the purpose above mentioned.

Should the retarding power thus produced, prove too great, it may be diminished at pleasure, by admitting a greater, or less, supply of steam, through the throttle valve.

2nd. Let the *escape* tube be furnished with a valve, similar to the throttle valve in common use: also, let a communication be formed between the *supply* and *escape* tubes, by means of a tube, furnished with a similar valve, and we have a modification of the steam engine, by means of which, the retarding power may be increased or diminished at pleasure.

The maximum resistance attainable by this arrangement, is equal to the full power of the engine, added to that of one atmosphere, acting upon the area of the piston.

REMARKS.

The improvements, or discoveries, intended to be embraced and described in the foregoing specification, and claimed as original and new, are,

1st, The compound movements of the carriage wheels and their axles, as applied to the Locomotive Engine.

2nd, The arrangement of the machinery, in such a manner, that the power or action of the steam engine in propelling the train of carriages, may be applied directly to the wheels that sustain the Locomotive Engine, or, to the pinions attached to their axles; thereby adapting the locomotive power both to the passage of horizontal roads, and to the ascent of inclined planes.

3d, The mode of retarding the engine, and its train of carriages, in their passage downward, on inclined planes.

SECOND METHOD.

The agents to be employed in effecting the transition from one level to another, agreeably to the method now under consideration, consist of the following machines, viz.

1st, A Locomotive Engine, differing from those in present use, in the substitution of a cog-wheel and axle, and two pinions, instead of the toothed wheels and endless-chain; in the introduction of an additional pinion upon the axle of the cog-wheel just mentioned; and in the addition of sockets or steps, to serve as receptacles for props, to elevate and sustain the entire weight of the engine.

2nd, A machine to be denominated the Rail-road Crane, to be employed for the purpose of elevating the Locomotive Engine so high, that its wheels may revolve freely without impinging against the rails of the road, and for other purposes.

3d, A Hydraulic-Double-Brake, and other apparatus, for the purpose of retarding a carriage, or train of carriages, in their passage down an inclined plane.

The parts of which these several machines are composed, and the uses for which they are intended, so far as they may have any claim to novelty, either in their construction, or manner of operation, will be considered in the following

EXPLANATIONS OF THE DRAWINGS.

Fig. 4. A view of the carriage of the Locomotive Engine, adapted to the method above mentioned.

A, The carriage-wheels, firmly connected to their axles, which traverse in steps attached to the carriage frame, or bed.

a, Pinions cast with the wheels A, and acting upon the cog-wheel B.

x, The crank-wrists, upon which the steam engine operates.

B, A cog-wheel firmly attached to its axle *b*, and serving to equalize the revolutions of both pairs of wheels; as also the action of the steam-engine upon them, and at the same time giving motion to the pinion C.

D, Parts of the carriage-frame or bed, to be supplied with steps or bearings for the axles above mentioned.

N. B. Cog-wheels, and pinions, may be attached to both sides of the carriage, instead of one side only, as represented in the figure, in case the single set should not be found to answer the purpose so well.

Fig. 5. A view of the Rail-road Crane, and several of its appendages.

E, The cheeks, or side timbers of the crane, connected together by the ties or girders, *e*. The cheeks are to be furnished with props at R, and with friction wheels immediately below the props.

F, Windlasses furnished with wipers, or excentric wheels, corresponding to the friction wheels of the cheeks, or frame.

f, Leavers, or segments of wheels, by which the windlasses are made to traverse on their gudgeons.

G, Cills or sleepers, furnished with steps at *g*, for the reception of the gudgeons of the windlasses.

H, A cog-wheel, firmly attached to the shaft *h*, and adapted to the reception of the pinion C, fig. 4, by which it is to be put into action. *h*, A shaft or axle, turning in steps attached to the cheeks, E.

I, A toothed wheel or pinion, fixed to the centre of the shaft *n*, and fitted for the reception of the endless-chain, by which the loaded carriages are to be drawn upwards on the inclined plane.

K, Ties furnished with oscillatory joints at *k*, and connecting the crane to the posts L, which are to be firmly set in the ground within the rail-track.

M, The rails of the ascending rail-track, situated above the windlasses.

NOTE.—The only parts of the crane which will present themselves above the surface of the road, are the props, a portion of the frame, the ties, and the heads of the posts. The other parts, together with their adjustments, are to be situated in a pit, walled with masonry, and adapted in other respects for the reception of the crane.

FIG. 6.—A side view of the Rail-road Crane, showing the position of a carriage ready to be elevated by it. The explanations of all the letters of this figure, from A to M, inclusive, are the same as those used in reference to figs. 4 and 5, which see.

N, A chain to be acted upon by a wheel and windlass, or by a pulley power, whereby the windlasses FF are to be put in motion, by means of the branch chains *n*.

O, Segments of wheels receiving the action of the chains *n*, and communicating it to the windlasses, as before intimated.

P, Wipers, or excentric wheels, fixed to the windlasses, and receiving the friction wheels of the crane upon their peripheries.

Q, The friction wheels supplied with flanges or guides at their rims, to prevent them from slipping laterally upon the edges of the wipers.

q, Steps and bearings adapted to the reception of the friction wheels.

R, Props for sustaining the Locomotive Engine, when the crane is made to act upon it.

r, Sockets or steps attached to the frame of the carriage, and serving as receptacles for the heads of the props; the figure indicates a section through the centre of the sockets.

N. B. The crane, and the carriage, must be so adjusted to each other, that when the props are brought into close contact with their sockets, the wheel H may be in complete gear with the pinion C, and remain so when the carriage wheels shall have been lifted from the rails of the road.

OPERATION.

The chain N, being drawn upward, the wiper P will act upon the friction wheels Q; the frame E will be elevated, and the props R brought into close contact with their sockets *r*, at the same time the cog-wheel H will be thrown into gear with the pinion C. Continue the draft of the chain N, till the carriage wheels A, are lifted from the rails M, the whole weight of the Locomotive Engine resting upon the crane. The steam engine being now put in action, as usual, on the road, the toothed wheel I, will revolve in such a manner as to draw the upper portion of the endless-chain *i*, in a direction corresponding to that of the carriages passing upon the rail-way. The carriages being now attached to the endless-chain by suitable fastenings, will be drawn upward on the inclined plane, towards the rail-road crane.

Fig. 7.—A view of the Hydraulic-Double-Brake, and some of its appendages.

S, A toothed, or cog-wheel, for the reception of the endless-chain of the descending rail-track, or plane.

s, A shaft, or axle, having a horizontal position, at right angles with the direction of the rail-track.

T, Vertical posts furnished with steps, in which the axle *s* traverses.

N. B. The posts must be so secured by means of stays, or otherwise, as to maintain their vertical position, however great the force acting upon the axle may be.

V, Trunks, or cylinders open at top, and furnished with a cock, or wicket, at bottom, through which a larger or smaller quantity of water, in due proportion to the action upon the shafts, may be allowed to pass.

V, Solid pistons, moving freely within the trunks.

W, Cranks, attached to the ends of the axles, and acting at right angles to each other.

W, Piston rods, connecting the pistons to the cranks.

Note.—The piston rods may either be inflexible, as represented in the figure, or may each of them be furnished with oscillatory joints, above that portion of the rod which enters the trunk. In this case, the joint must be adjusted with slides or other apparatus for maintaining a parallel motion.

N. B. When this machine is in operation the trunks must be kept full of water. For this purpose it may be adviseable to place the frame represented in the figure, within a well, or cistern, in which there should be a constant supply of water, sufficient to keep the whole of the trunks immersed considerably below the surface.

OPERATION.

The principle upon which the brake operates, is the resistance encountered by the pistons in their passage through the water contained in the trunks. This resistance will be greatest, when the cocks, or wickets at their bottoms, are shut.

The carriage about to descend, is hooked to the upper, or descending portion of the endless-chain. In its progress downward, it draws the chain with it, and thus gives motion to the wheel, S. The cranks, W, operate in such a manner, that, when one is passing the dead point, or point of no action, the other is at the point of greatest action. The agency of the cranks is counteracted by the resistance of the pistons, which is thereby applied as a retarding power, to the descent of the carriages.

OBSERVATIONS.

It is assumed as a matter of fact, that a Locomotive Engine may be made to propel, on a horizontal rail-way, (without the intervention of a rack and pinion,) *its own weight*, and *eight times as much besides*. Also, that the same engine, exercising an equal degree of power, is able to propel *its own weight* upward, on an inclined plane, whose height is to its length, as 1 to 16½, nearly, or about three hundred feet to a mile, the rails being kept clear of mud and ice.

The method under consideration provides for the ascent of the Locomotive Engine by itself, and afterwards for that of the train of carriages, by applying the power of the engine to the endless-chain, through the medium of the machinery described under figures 4, 5 and 6.

The gearing of the machinery may be so adjusted, that the whole train of carriages may be drawn up at once; or should it be found more convenient, and less expensive, that a single carriage only, or any other portion of the train, may be drawn up at a time.

It is obvious that the crane must be appended to the ascending rail-track, and located at the head of the inclined plane, at such a distance therefrom, as to make room for the entire train of carriages to stand upon the horizontal way, between the plane and the crane.

The Hydraulic-Double-Brake must be located in the descending rail-track, near to the head, or foot of the plane, or both if required, and may be so adjusted, as to regulate the descent of one, or more, carriages at a time, as may be found most convenient. The chain, or other apparatus, connecting the carriages to the endless-chain that plies upon the brake, must be applied in such a manner that it will of its own accord, unhook, or disengage itself, at the moment when the carriage arrives at the foot of the inclined plane.

REMARKS.

The improvements, or discoveries, intended to be described under the second method, as comprehended in the foregoing essay, and claimed as original, and new, are—

1st, The mode of propelling the Locomotive Engine, and its train of loaded carriages, upward, on an inclined plane.

2nd, The mode of retarding loaded carriages, in their passage downward, on inclined planes.

3d, The invention, and application, of the Rail-road Crane:

4th, The discovery, and application, of the Hydraulic-Double-Brake.

THIRD METHOD.

The method now under consideration, differs from that last described, in the construction of the carriage, and in the arrangement of the machinery of the Locomotive Engine, also, in the substitution of an appendage less complicated than the Rail-road Crane, in connexion with the endless-chain.

The modifications of the Locomotive Engine, contemplated under this head, and those of the machinery, by means of which, the power of the engine is to be applied to the transfer of the train of carriages from a lower to a superior level, are to be considered in the following description of the machinery, and

EXPLANATIONS OF THE DRAWINGS.

Fig. 8. A view of the carriage of the Locomotive Engine, showing the position of the boilers, &c.

A, The carriage wheels, each of which is furnished with a short axle, traversing in steps attached to the carriage frame. *a*, Pinions, connected with the carriage wheels, being cast with them.

B, Cog-wheels, traversing upon their axles, to which they are connected by a sort of lock gearing, by means of which they may be made to revolve conjointly, or the axles may revolve, independently of the wheels, as the lock is applied to, or withdrawn from, the wheels. The lock is to be so adjusted, that it may slide freely on a square part of the axle, and embrace the arms of the wheel, B. *b*, Cranks, attached to the axles of the cog-wheels, B; and together with the crank-wheels, C, and the cranks, *c*, receiving the action of the steam engine, and communicating it to the carriage wheels by means of the cog-wheels, B, and the pinions, *a*.

C, Crank-wheels, serving to communicate the power of the engine to the cog-wheels, I, fig. 9. when in gear with the latter.

c, Cranks, situated at right angles to each other, and serving to equalize the action of the steam engine upon the carriage.

D, An axle, connecting the cranks, *c*, and traversing in steps attached to the carriage-frame.

E, Beams, or ties, connecting the sides of the carriage frame.

d, Timbers, for the support of the axle, D, and furnished with steps for its reception.

e, Staples, to receive the hooks of the rods, *n*, fig. 9.

F and G, Cheeks of the carriage, two on each side, furnished with steps for the reception of the axles of the wheels, A, and cog-wheels, B and C. The carriage wheels, &c. are to revolve freely within the cheeks.

H, Head-locks or transums, to which the ends of the cheeks are firmly attached.

Q, The places of the boilers.

Fig. 9. A view of the machinery substituted for the rail-road crane.

I, Cog-wheels, to receive the action of the crank-wheels, C, fig. 8, and communicate it to the endless-chain, by means of the toothed-wheel, K.

K, The toothed-wheel, adapted to the reception of the endless-chain.

L, A shaft, furnished with gudgeons, upon which it may traverse, and with wipers, or plugs, immediately below the cheeks, M. The shaft is to be furnished with a lever at *l*, by which it may be turned forth, and back, at pleasure.

M, Cheeks, receiving the steps of the axle, *k*. The cheeks are furnished with oscillatory joints at N, where they are supported by a pivot, *m*, while at the other end they rest on the wipers of the shaft, L.

N, Posts, set in the ground within the rail-track. To these the cheeks, M, are attached, in the manner just intimated.

n, Rods, furnished with hooks at one end, and traversing on the pivots, *m*, at the other. The rods are to be adjusted in such a manner, that when the axle, D, (fig. 8.) is directly above the axle, *k*, (fig. 9.) their hooks may enter the staples, *e*.

O, The rails of the rail-road.

Fig. 10. A side view of the Locomotive Engine, and the apparatus employed in connexion with the endless-chain. The letters of this figure, from A to O, inclusive, refer to the same parts of the machinery as in figs. 8 and 9, which see.

P, One of the steam cylinders, supported on a frame work of iron suitable for that purpose, and firmly attached to the cheeks, F and G. Two cylinders, as usual, viz. one on each side of the carriage, are to be employed in this case.

P, The sweeps, or connecting rods of the steam engine, acting upon the cranks, *b*.

Q, Cylindrical boilers, each of which is composed of two cylinders of different lengths and diameters, having a vertical position. The shorter is included within the longer, allowing a space of about one foot between their heads, and of five or six inches between their sides. The interior of the smaller cylinders are to serve as fire-places, and are, accordingly, to be furnished with suitable grates at the bottom.

q, The doors, through which the fuel is to be administered.

r, The flues leading from the fire-places.

K, The chimney appended to the middle boiler, the interior cylinder of which is to be of equal length with the exterior.

S, Braces, for the support of the chimney, and the upper parts of the machinery.

s, A transverse bar, to which the braces are attached, and a band connected therewith for the reception of the chimney. The slides, or slide-bars, regulating the movements of the piston rods, are to be connected with this bar.

v, A dotted line, indicating the surface of the water in the boilers.

x and *y*, The place of the endless-chain, the motion of which is in the direction from *x* to *y*.

In reference to the system of boilers herein proposed, a few remarks only need be offered on this occasion.—It will be perceived, that the intermediate, or centre boiler, is somewhat different from the others in its construction, the reason whereof, is, that it is not intended for the reception of fuel, but serves to unite the flues of both the others, in the following manner. From the openings, *r*, the flues lead downward between the middle and outside cylinders, communicating their heat to both, exteriorly. The flues then unite under the bottom of the centre boiler, and the draught is conducted upward through its interior, and passes off through the chimney. The combined heat of both flues will probably occasion a temperature nearly as high, in the middle, as that in either of the outside boilers. The chimney should be of a diameter considerably less than that of the inner cylinder of the middle boiler, and should be inserted so far, that its lower extremity may remain below the line of surface water in the boilers. The space between the chimney and the cylinder, should be filled with a lute of fire-clay, or other non-conductor.

In order to adapt the boilers of the Locomotive Engine (constructed agreeably to the manner pointed out under this method) it was found necessary to assign to the middle boiler, a diameter, and length, considerably less than those of the others.

It should be observed further, that the flues between the boilers ought not to rise higher than the line of surface water at *v*, and that they should be walled, on those sides not contiguous to the boilers, with light sheet-iron, lined with fire brick, or suitably luted with fire clay. The flooring, or hearth, of the flues, occupying the whole distance between the two outside boilers, and placed so low as to allow a free communication with the interior of the centre boiler, should be constructed of sheet iron, overlaid with fire bricks, or lute.

Ash-pans of a suitable form and construction may be placed under each fire-place. These may be furnished with shutters, in a manner to exclude, or admit, the atmosphere into the furnace, at pleasure.

Another mode of damping the heat of the fire-places, is suggested, as follows. Let a thin plate of iron, large enough to cover the entrance of the flues into the middle boiler, be placed directly beneath the latter, resting upon the hearth of the flue. Let the plate be so adjusted, by means of a rod, lever, or winch, that it may be elevated till it comes in contact with the boiler, and depressed again at pleasure from without. The draught of the chimney may by these means be increased, diminished, or totally intercepted, as the nature of the case may require.

OPERATION.

In the ascent of inclined planes, the Locomotive Engine is to proceed upward by itself, to the site of the machinery represented in fig. 9. On arriving thereat, the hooks of the rod *n*, are to be applied to the staples *e*. Let the shaft L, be turned by the lever *l*, till the cog-wheels I, are thrown into the crank wheels C. Let the locks be slipped from the wheels B, either before or after the preceding operation. The power, or action, of the steam engine, will then be applied to the endless chain *x y*, and the train of carriages drawn upward, in the same manner as represented, agreeably to the second method.

The mode of descending inclined planes, is precisely the same as that contemplated under the method just cited.

REMARKS.

The improvements intended as the subject of description under the third method, and claimed as new, and original, are as follows, viz:

1. The mode of applying the power of the steam engine in propelling the Locomotive Engine and its train of carriages, together with the arrangement of the machinery for the accomplishment of those objects.

LONG'S LOCOMOTIVE ENGINE

Plate 1.

Fig. 2.

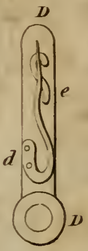


Fig. 1.

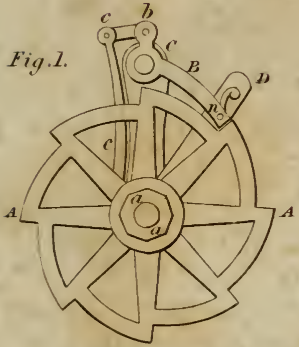


Fig. 4.

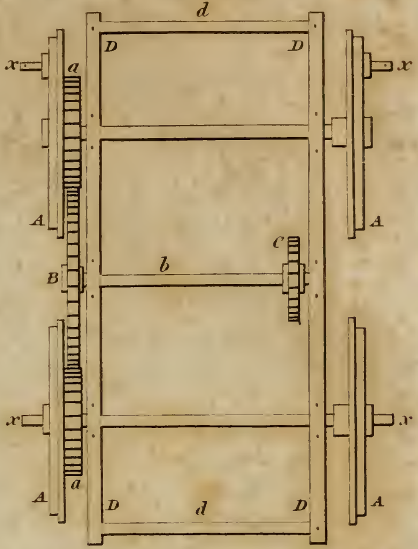
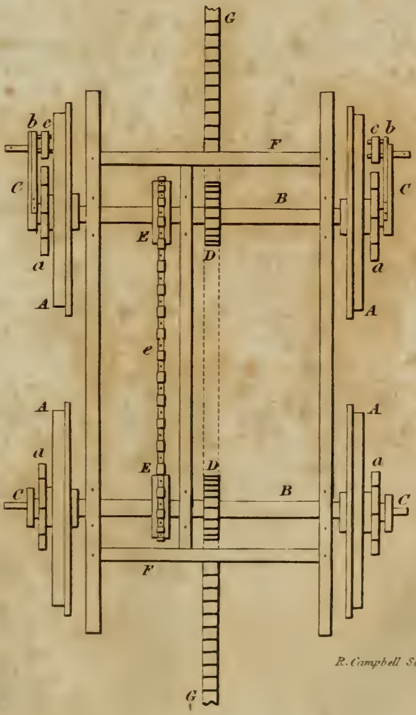


Fig. 3.



S.H. Long Del. R. Campbell Sc.

LONG'S LOCOMOTIVE ENGINE

Plate 2.

Fig. 5.

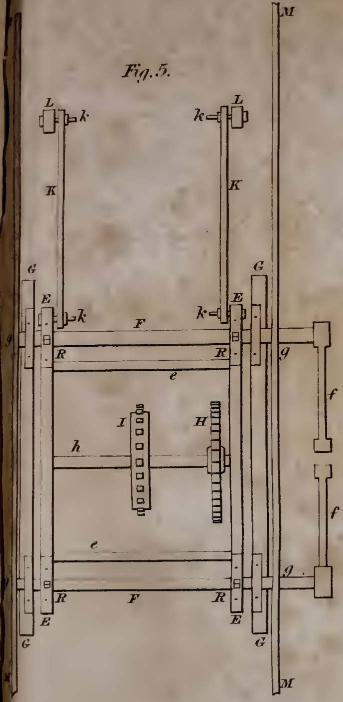


Fig. 8

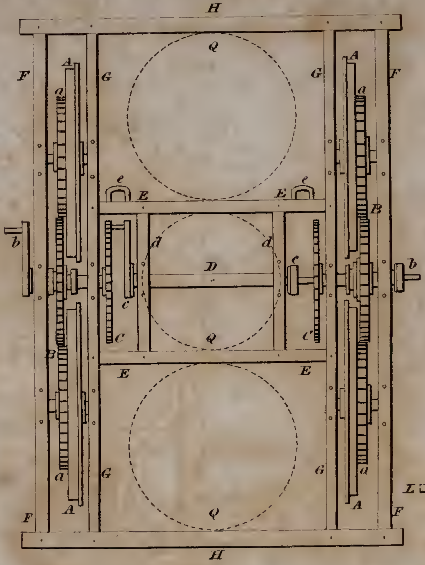
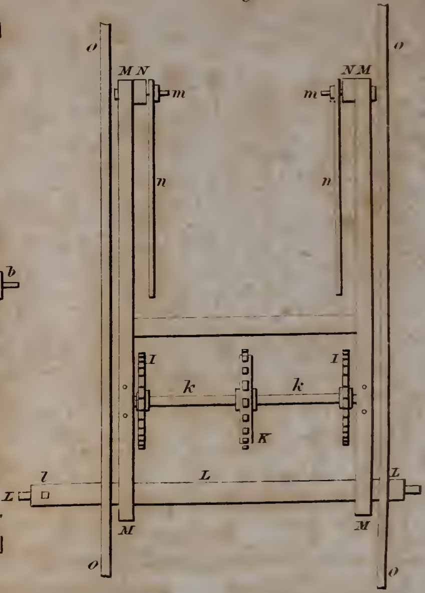


Fig. 9.



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R. Campbell Sc.

LONG'S LOCOMOTIVE ENGINE

Plate 3.

Fig. 6.

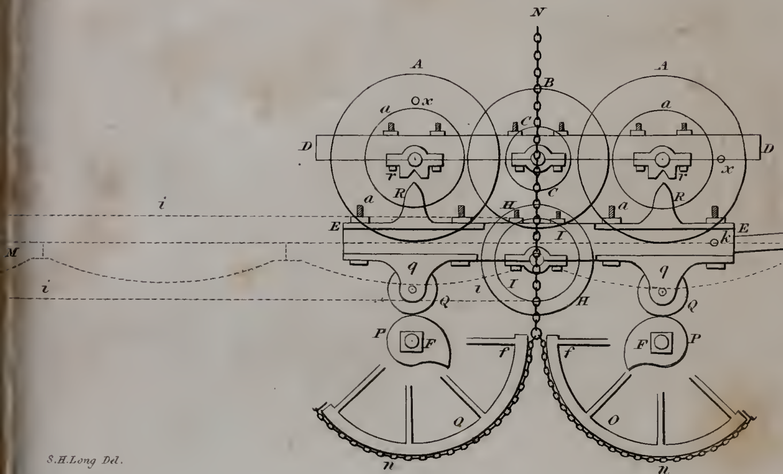
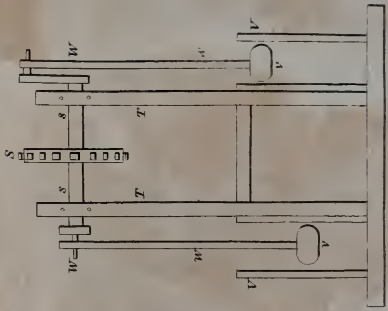


Fig. 7



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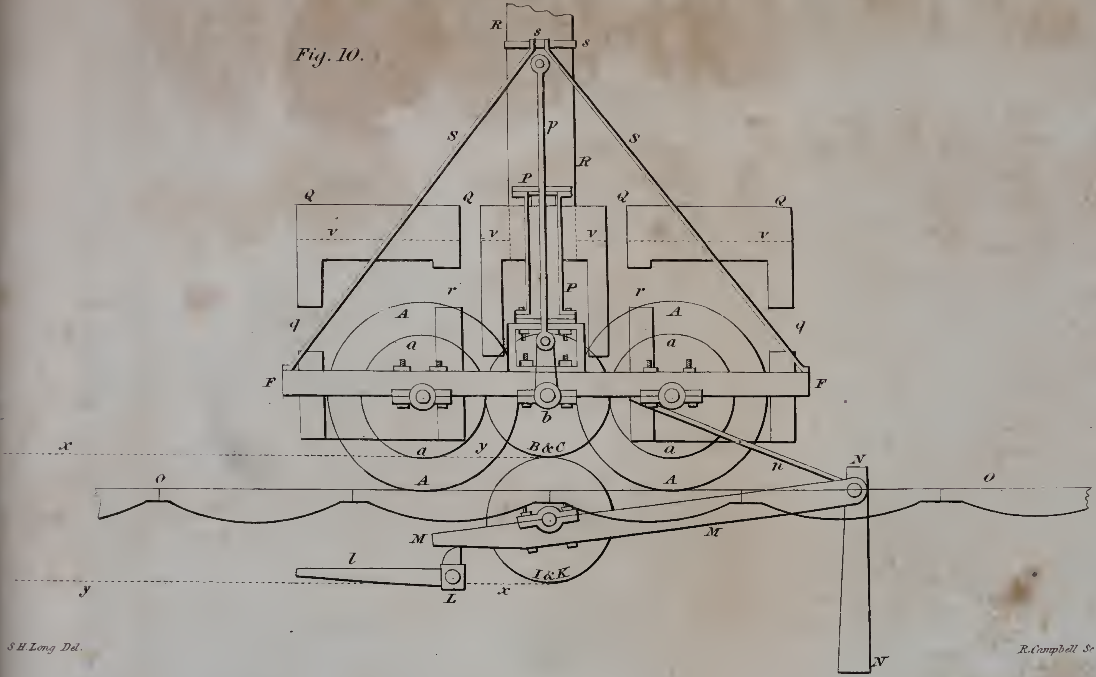
LONG'S LOCOMOTIVE ENGINE

Plate 4.

Fig. 10.



S.H. Long Del.

R. Campbell Sc.

2. The adjustments, and application of the gearing, connected with the endless chain.
3. The construction, and arrangement of boilers, or steam generators, adapted to the use of anthracite, or other coal, as fuel.

An Essay on the Bombyx Mori, or Silk Worm, read before the Maclurean Lyceum of Science of Philadelphia, June 11th, 1826. By JOHN T. SHARPLESS, M. D.

(Continued from p. 100.)

In my remarks upon the propagation of the mulberry tree, I shall first describe the plan pursued by the Chinese. After the seeds are prepared, they soak them in a lye of the wood of the tree, and sow them in rows, in the spring, in ground which is rather moist, and has been long uncultivated, but which has been prepared, and well manured with ashes, or the mud from rivers or marshes. In January following, they trim off all the superabundant and crooked branches, and leave only those that are straight, and which stand at some distance from each other, permitting but four eyes to remain on them; and that the air and sun may have free access to the centre of the bush, they make it quite hollow within. The forked and crooked stems, are cut off close to the ground, that they may put forth straight. After the first year, the main shoot is not touched; but the side ones are kept close, till the tree has gained the full height of five or six feet. They should be transplanted in the second year, at a distance of eight paces; and when they have arrived at their height, the top should be cut off, and the side branches allowed to grow, till they form an inverted cone; every part of which, should be accessible to the gatherer. They are careful to remove all the fruit as soon as it appears; considering it as a useless consumer of the powers of the plant; but they are extremely careful to leave sufficient leaves to carry on the vegetative process, even on the oldest of their trees. When the tree becomes old, and its resources evidently exhausted, it is, in the spring, cut off near the ground, and a graft set in; or if merely a limb becomes withered or dead, it is removed, and a new bud put in its place. By these means, they are preserved from fifty to one hundred years. The Chinese also propagate the tree by the slip, or by bending long branches down, into the ground; and when these have taken root, they are separated from the parent tree. Loureiro states, that in Cochin China, the whole plant is rooted up every third year, and fresh plantations made of the cuttings, under a belief, that the very young shoots produce the finest silk.

In France and Italy, according to Sauvage, Count Dondola, and M. Thomé, the seeds must be sown in July, August, March, or April, in good ground, not too dry. But a better plan is, to place the berries themselves in the earth, either by simply covering them up, or by mashing them on a hair clothes line, till they stick in considerable quantity, and then laying it in a trench, and covering it with earth.

The pulp of the fruit, in this case, forms a constant source of nourishment, till the seeds sprout. For the first three years, the defective, and crowded sprouts and branches, are removed; at the end of this time, the faultless shoots are taken up, the long, tapering, main root, is cut off, that the side ones may grow, and are then transplanted 1½ feet apart. If ingrafting is not practised, the trunk is cut off, so that but one eye remains; this is treated as though a graft had been set in. It has however been found, that ingrafted trees are much the most productive of good leaves, though less durable; the natural trunk living sometimes nearly 100, whilst the artificial branches seldom endure more than 10 or 12 years. If the plan of ingrafting is followed, the graft should be set in after the first transplanting in July; a good stock should be selected, and cut off, to within two inches of the place of the graft, which must be as near the ground as possible; and when it has well sprouted, the remaining two inches should be cut off, that the shoot may grow straight. In March, or April, following, the trunk must be trimmed, that the height may be increased; and when it has grown to 6 or 7 feet, the top must be removed, and the bush treated as by the Chinese. In the fifth year from the seed, the trunk is generally about two inches in diameter, and must be placed in a permanent situation. The land best adapted for this last change, is such as is usually denominated good grain land, which should be broken up, several months before the time of planting. The holes must be made large, and about thirty feet apart, and nearly filled with good manure. The bushes should be taken up in a damp day, and all the roots cut off, to within six inches of the main root. After they are planted for the last time, the ground at the foot must be shielded from the sun, by straw, till it has taken hold of the earth.

In the Isle of France, M. Chazel allowed three feet distance between each plant, and permitted them to grow but five feet high, cutting them down near to the ground, every few years. In England, the modes pursued, have been similar to those described. In Pennsylvania, the tree had been allowed to grow to its full size, without any care, until a system was introduced by the late Mr. Paul Busti. He planted the fruit about three inches apart, and covered them with a thin coat of earth, and then a layer of soot, plaister, or lime; and in the second year, selected the good shoots for transplanting. His mode of ingrafting, was rather unusual, and perhaps unnecessarily troublesome. He chose a good trunk of a wild tree, of small size, whilst the sap was in full run, and having cut it down to within six inches of the ground, he denuded it of its bark for one or two inches, by a cut perfectly smooth, that the capillary vessels might not be injured. From a limb of the same size as the tree he wished to propagate, he then cut in the same way, and twisted off, a cylinder of bark containing several eyes. This was slipped on the denuded trunk, and the cut edges made to fit exactly, and the joint and end, closed with soft clay.

Mr. John Fitch, of Mansfield, Con. in a letter to me, says, the ordinary mode of procuring leaves there, is from the tree raised in a nursery, from the seed, and transplanted; the sowing and mowing system having failed, from the early death of the roots.

Mr. E. C. Genet, of Albany, whose communication to the committee of Congress was printed in their report, has kindly obliged me with a long description of the plan he has observed to be most successful. He says he is perfectly confident, that the mode pursued in some parts of France and China, of keeping the bushes low, and in hedges, is the best; that they shoot much earlier in the spring, are more readily protected from the frosts, give a much greater quantity of the most luxuriant and nourishing leaves, and are much more easily gathered. They should, however, be kept under constant irrigation; and with care, will last a long time. He says, the plant may be raised from the seed, or slip; when the latter are used, they should be thrifty sprouts, one and a half feet in length, and planted late in the fall, in a good light soil, well prepared by deep digging, and manuring; and adds, "if that light, sandy, black mould, called by the French, *Terre de Bruyere*, or heath soil, and much employed by the gardeners of that country, was used, success would be infallible."

Of all authors I have read on the subject, no one has given so particular, and, perhaps, so correct a history of this matter, as the Rev. Mr. Pullein, and the succeeding remarks on the subject are collected from his work. He mentions the preceding plans, but considers, *that* from the seed the most rapid, and perhaps the best that can be pursued. He recommends that the berries be mashed on a hay rope, and laid in a trench and watered; the hay, as it rots, becoming good manure for the roots. He thinks seeds that have passed through the body of some animal, shoot much sooner than others, and proposes that they be mixed with flour, and given to dogs, and the dejections of the animal planted, surrounding the seed. The soil best adapted to the plant, however it be cultivated, is a loose, rich mould, inclining to sandy, and under which is gravel rather than clay, as the latter holds the wet, and chills the young plants. It should also be deep, as the roots shoot much downward. The seed must be sown as early as the ground can be broken in the spring, and watered every second day, and a layer of fine coal or soot, placed on the bed, will retain the heat of the sun, and facilitate the sprouting. They should now be watered and hoed frequently, to destroy the weeds and slugs that infest the roots, but he proposes to keep off the worms by a layer of soot around the stems, or, by a horse hair rope, with the hair projecting, and cut short; this annoys the animals, and they soon disappear.

The next most easy cultivation is from the cuttings. These should be large branches, three inches in circumference, with many side shoots. Limbs from old, and even superannuated trees, will answer every purpose; and may be three or four feet long. The cut ends are to be dipped in tar or pitch, or seared with a hot iron, to keep out the moisture of the earth, and then laid in deep trenches; this should be done in autumn, and in land that has been broken up, and enriched with manure, or loam, some weeks before. These trenches should run from north to south, and be about four feet apart, that the rows may not shade each other. The side shoots ought to be bent up, so as to project about six or eight inches above the ground. If the winter is severe, cover the shoots with straw, and be careful that cattle do not eat them off. In two years, with attention, they may be separated from each other, and transplanted into regular hedges, running in the same direction. He thinks they should now be kept flat by sticks, run through them, like espaliers; and the branches that project at right angles cut off.

He also proposes dividing large roots into small pieces and then planting them.

After transplanting, they are permitted to grow only to a height of six or seven feet, and must not be robbed of their leaves before the fourth year. The great advantages of planting the hedges to run from north to south, and of laying them flat, are, that the sun has free access to all parts of the bush, and by shining on the whole of one side early in the morning, the leaves are dried, and fit for food much sooner. The roots are also much more exposed to the rain, from the small space covered by the tree.

When the leaves are gathered, it should be by those who do not use tobacco or garlic, and they must have clean hands: they should not be rudely pulled off the limbs, but each bunch removed without mashing, or the branch be cut off with a sharp knife, with the obliqueness of the cut presenting downward, that the wet may not get in. After being gathered, they must not be crammed tight into a bag, but left loosely in baskets, and turned over frequently that they may not become damp. The food for the day should be collected in the morning, for the noonday sun withers the leaves, and makes them less suitable.

Mr. Pullein proposes a plan for the cultivation of the worm, but which he had never tried; it is to allow the worm to take care of itself, on a tree, to ascertain if a better breed might not be raised. He advises, to select several young, healthy bushes, and plant them in large boxes, placed in the house, but exposed to the air. These, if necessary, may be covered by netting, to keep off the insects; and he proposes to water them by a rope of tow round each principal branch and stem, the ends of which is placed in a vessel of water, the capillary attraction supplying the tree with moisture.

It is, perhaps, impossible to judge which of the plans, heretofore mentioned, would be the most adviseable for this country; all may be tried, and experience will best decide. It is requisite to discover the quantity of leaves that can be raised, or rather, how many worms may be fed, and how much silk produced from a given portion of land. The accounts of the most respectable writers differing so much, that little certainty can be gained from the evidence now before us; witness the discrepancy in the relations of Mr. Fitch, and Mr. Genet, published last spring, in the report of the committee of congress. Mr. Genet says, "one twentieth of an acre planted with bushes not more than three years old, will supply one hundred thousand worms, and will produce thirty pounds of drawn silk; and if a whole acre be so planted, the product will be six hundred pounds, which is worth, at present, three dollars per pound." At this calculation, one acre will supply two millions of animals. Mr. Fitch states, that "one acre of full grown trees, set one and a half rods apart, will produce forty pounds of silk, which is worth five dollars the pound, making two hundred dollars." Here then is the great difference of one thousand six hundred dollars in the product of a single acre. Mr. Genet continues, "forty thousand worms will consume one thousand pounds of leaves, easily supplied by fifty grown, or two hundred small trees, of two or three years; and the produce will average twelve pounds of drawn silk, allowing for contingencies." Anxious to ascertain the cause of this apparently enormous inconsistency, I took the liberty of writing to both the gentlemen, and they kindly sent the following replies. Mr. Fitch says—"The estimate I gave is about the average that can be obtained, though there is one tree, in Mansfield, that has yielded four pounds of silk. This luxuriance depended on its location, being near the house, in good soil, and receiving the wash thrown out." Mr. Genet declares that from his "experience and observation, mulberry trees, trimmed down every year near to the ground, as is practised in the willow for baskets, will yield much more than if placed in orchards, to grow to a full size. The most correct calculation is, that fifty trees, of twenty-five or thirty years of age, will produce, with proper care, nourishment for forty thousand worms, and will yield but eight or ten pounds of silk." After stating that an advantage is gained with the trees, by making use of the ground under them, he continues, "whilst one hundred trees raised in that way, which may occupy one acre, will make but twenty pounds of silk; I am confident, if the shrubbery, or hedge system is pursued, the quantity mentioned in my report to congress, may be procured." According to these accounts, and we cannot doubt the evidence of gentlemen so respectable, the plan of Mr. Genet is decidedly preferable, and the particular manipulation of this style of cultivation is perhaps stated most correctly by Mr. Pullein.

The late Mr. Busti planted and engrafted many hundred trees, most of which, however, have been since destroyed. Mr. Dusar, who also deserves the gratitude of his fellow-citizens for his assiduity in propagating a knowledge of the mode of managing the worm, has now under cultivation, a large quantity of trees of the best quality.

The actual quantity of leaves consumed by the insect is also a matter of some consequence. Count Dondola, who has probably made the most minute enquiries on the subject, says, "The quantity actually consumed by five oz. of ovæ, or two hundred thousand worms, is, in

the 1st age	20 lbs.
2nd do.	55
3d do.	216
4th do.	620
5th do.	3,820
	4,731

"This, with the waste, will make five thousand four hundred pounds of leaves." He also states, that "one hundred eggs will weigh but one grain, and that number of worms in thirty days will weigh nine thousand five hundred grains."

I will conclude with a few remarks on the number of persons required to attend a certain quantity of animals, and reel the silk. In the directions printed by the 'Filature of Philadelphia,' it is said, that when the trees are convenient, two persons will attend and feed six oz. of eggs, or two hundred and forty thousand worms, until ten days from spinning, when five or six active children will be necessary. Mr. Fitch considers but one person necessary for the first three weeks, to attend one hundred and thirty thousand, and for the following fifteen days, or till they spin, five persons, chiefly women and children. Care should be taken to prevent the possibility of neglect, from inattention, or sickness in the tenders; for twenty-four hours starvation, will annihilate the most promising prospect. With regard to the reeling, the gentleman just mentioned, estimates the labour of five persons, for fifteen days, amply sufficient to pick off and reel forty pounds of silk, or one hundred and thirty thousand cocoons. Mr. Peter Nouailles, of Kent, says, that the women of Novi in Italy, can, with the assistance of a girl to turn, reel off, per day, one pound of silk of the first quality, of five threads, with two skeins on the wheel at once; but when she is allowed to put five or six skeins on, she can reel off six or eight pounds, of bad, rough silk.

With all our present exertions, raising silk will never prevail to the extent to be desired till markets are established for the produce. The poor, and labouring classes, should be encouraged to undertake the culture, but can they send their silk to England to be throwsted and woven? They can hardly possess the conveniences for reeling. Societies should be established, similar to the Filature of 1770, and sufficient capital be devoted to the purchase of cocoons, or reeled silk; let them procure machinery and workmen to manufacture the article, and then a certain return for their labour will induce the industrious classes to join in the business.

Why should England, France, Italy and China enjoy alone, an immense revenue arising from a source of wealth so completely within our power? It is a subject of national importance, and well deserves all the encouragement congress can bestow upon it.

Note.—In the first section of this article, I mentioned, that Mr. Miner had introduced his motion in Congress, at the suggestion of Mr. Alexander. Into this error I was led, by seeing a letter from Mr. M. to Mr. A. after that motion, in which he says, the nation is more indebted to Mr. Alexander, than to himself, for the introduction of the worm to public attention. This communication, I supposed, was an answer to a letter, in which Mr. A. had urged the resolution. The high respect I feel for the distinguished talents, and patriotic exertions of Mr. Miner, has induced me to embrace this opportunity, of giving the credit where it is due. I have been informed by one of his particular friends, since the publication of the first section of this essay, that the act was solely the result of his *own* mature judgment, having long since shown himself deeply interested in the matter, by his writings and conversation.

FRANKLIN INSTITUTE.

Report of the Committee of Inventions, on an improvement in the Fire-ladder, for which improvement a patent has been obtained by SAMUEL LEHMAN, *of the city of Philadelphia.*

The Committee of inventions, having had referred to them for their examination, a model of an improved fire-ladder, invented by Mr. Samuel Lehman of this city;

Report, that they have attended to that duty, and that the following is the construction of the machine. The ladder is divided into two parts, each ordinarily to be about twenty-five feet in length; the lower section lies upon a strong carriage, to which it is affixed by a hinge-joint; upon this, is placed the upper section, which is retained in its place by iron hooks or clips, which allow it to slide upon the lower section, so that it may be drawn out, and with the lower section, form, when elevated, a ladder of about forty feet in height, a sufficient lap being allowed, to insure the necessary strength. The carriage has two wheels at its forepart, and at the other end there are projecting handles, or shafts, with legs, or supports, the whole being similar to those of a common wheel-barrow, or truck, with two wheels. The ladder is so balanced upon its carriage, that the handles may be lifted, and the whole guided by a man of ordinary strength, whilst three or four persons may draw it by means of ropes, attached to it for that purpose.

In order to elevate the ladder, a windlass is affixed to the under part of the carriage; and two posts, firmly braced, are mortised into the upper part of the frame, near the foot of the ladder; these rise, perpendicularly, to the height of seven or eight feet, and have sheaves at their upper ends, round which pass ropes from the windlass, the ends of which ropes, are attached to the lower section of the ladder, seven or eight feet from the hinge-joint. On turning the windlass the ladder will be elevated, and when raised to the proper angle, it is sustained by means of two long braces, or arms, attached to it by staples, the lower ends having iron straps, with holes which slip on the extremities of the axle-tree.

The upper section of the ladder is made to slide up by means of a second axle, under the carriage, the rope from which passes over a roller at the upper end of the lower, and is attached to the foot of the upper section; by means of this it may readily be forced up to the requisite height.

There are some other appendages, which being of minor importance, it is not deemed necessary to describe. The whole manifests considerable ingenuity, and the parts are well arranged. The Committee, however, are of opinion that it is too bulky for use in a large city, where ground is valuable, as it would require a house nearly thirty feet in length, about eight in width, and ten in height; this they apprehend will operate as an insuperable objection to its adoption here, especially, as the means already possessed by us of extinguishing fires, are of the most efficient kind, and the common ladder is very rarely used. There are, undoubtedly, many situations in which such an instrument may be very advantageously employed, not only in cases of fire, but also for attaining different elevations by means of the same ladder, which may be easily raised and removed. The Committee have not thought it necessary to notice certain apparatus heretofore invented, with similar views, as they are not acquainted with any which materially interfere with the arrangement of that now under consideration.

By order.
THOMAS P. JONES, *Secretary.*
Philadelphia, August 19*th*, 1826.

FOR THE FRANKLIN JOURNAL.

EDUCATION IN MEXICO.

Extract of a letter from a distinguished Member of the Franklin Institute, now in Mexico.

In the city of *Peuebla de los Angeles*, on the route from Vera Cruz to this place, there is a society formed, for the dissemination of education, to all classes of the community. The short stay I made in that city, did not permit me to obtain a full knowledge of the principles upon which it is formed; but I was told, that it supported an elementary school, (*de primeras letras*) in which, about 500 boys are gratuitously taught reading, writing, &c. and connected with this, is a drawing school, in like manner, gratuitous; in which, about one hundred pupils are instructed. From the drawings which I saw, I was satisfied that some of them had made great progress. I was informed, that the scholars remain as long as they please in the school. No false pride prevents the rich (who are members of the society) from sending their sons to this school, to be instructed with the poor. It is gratifying to add, that notwithstanding all the abuse lavished upon the catholic clergy, as inimical to the diffusion of education, this society has been in a great measure supported by the liberal zeal of the Bishop, and of another respectable prelate, who is at present in his 80th year, and whose whole life has been devoted to the extension of learning, and to the diffusion of the principles of equal rights in all men. The society appears to include many objects, which, with us, would be divided between many. To promote the public good, by educating the poor; to encourage the fine arts; and to extend support to the useful arts, are, however, its principal objects.

In that city there are many manufactories, principally of Cloth, Cotton, Pottery, Glassware, &c. I visited many of them, and intended to prepare a notice of them for our Journal; but my stay there was too short, to allow me to do justice to the subject. Their pottery is remarkably good; I can assure you, that I wish we could have shown at our late exhibition, any that could compare with that made in this country.

MEXICO, May 23, 1826.

Letter from ROBERT HARE, M. D. *Professor of Chemistry in the University of Pennsylvania, to Dr. Thomas P. Jones, Editor of the Franklin Journal, containing observations on the explosions which have taken place in the boilers of steam engines.*

Dear Sir,—It has been suggested that some extraordinary evolution of the gaseous elements of water, or even an inflammation of aqueous vapour, may have contributed to the explosion of the boilers of Steam Engines, especially in the instance of the Steam-boat Ætna. You are desirous that I should communicate, for your Journal, a confutation of these impressions, so inconsistent with any accurate knowledge of the subject.

I have always been of opinion, that the accident on board of the Ætna, arose from the overheating of one of her boilers, while insufficiently supplied with water. That iron heated to redness, may be sundered by a force, to which it would not otherwise yield, seems to be justified by the well known power of heat in lessening the tenacity of metals. But whether this impression be right or wrong, I am decidedly of opinion that it is inconsistent with science, and unnecessary, to suppose any other agency in water, in the case in point, than that arising from its conversion into steam under confinement.

The Ætna was alleged to work, at times, with a pressure of one hundred and fifty pounds per square inch. In a boiler of twelve feet six inches, or one hundred and fifty inches long, and two feet nine inches in diameter, or one hundred inches in circumference, the number of superficial inches will be fifteen thousand; this multiplied by one hundred and fifty, gives a total of two millions, two hundred and fifty thousand pounds, as the total power to be restrained.

The sudden liberation of such a force, to act upon bodies around it, was far more than competent to produce all the dreadful features of the catastrophe, which happened on board the steam-boat above mentioned.

The conflagration of the gaseous elements of water, produces a more intense heat than any other combustion. This is ascribed to the evolution of an excess of caloric, which they hold when in the gaseous state, above that which they retain when forming aqueous vapour; and to the same cause we must attribute the violent explosion, which ensues, when a mixture of them is ignited, and thus transformed into steam. But if, during this union, these elements give out caloric, during their disunion, it must be absorbed by them. If expansion ensues in the first instance, condensation ought to take place in the last. Besides what is there, within a steam-boiler, to cause their disunion? The red-hot iron may decompose the steam slowly, but it can do so only by absorbing the oxygen, which must lessen the quantity of elastic matter in the boiler, and render the evolved hydrogen gas, inert; as, by itself, it cannot explode.

That water can become susceptible of inflammation, is inconsistent with all that I know on the subject. When passed over ignited anthracite, or coak, or mixed with inflammable carbonaceous vapours, it may, by its decomposition, yield hydrogen, while its oxygen uniting with the carbon, forms a gaseous oxide of that substance, which is susceptible of inflammation. But, in this case, it only substitutes one species of fuel for another. It neither augments the quantity of the fuel, nor the extent of the rarefaction.

It will be highly important to improve the means of indicating that deficiency of water, which permits the boiler to be unprotected by this fluid, in the part exposed to the fire. If the impression be correct, that a boiler may be weakened, by being heated to redness, I would employ the following contrivance.—A hollow globe being allowed to swim on the water of the boiler, should open a small cock, so as to produce a jet of steam in front of the boiler, whenever the water should sink too low.

While I coincide in the opinion, that overheating may be one cause of explosion, I am far from considering it as the only source of danger. A high pressure boiler, in England, although immensely strong, was burst, in consequence of the valve being fastened down by one person, while the engine was stopped by another. The late explosion in a boat on the Susquehanna, has been attributed to a like cause.

In steam-boats, as in other vessels, our safety will depend upon the prudence and vigilance of the captain, and the discipline established among the crew. Steam-boats will be blown up, sail-boats will be upset, and stages run away with, broken down, or overturned, in despite of any preventive. Nevertheless, as accidents in the case of steam-boats, will be less destructive in proportion as less pressure is used, it would seem imprudent to extend it beyond eight pounds per square inch. This has been proved adequate to give a velocity of eleven miles an hour to a properly constructed boat,* and even this pressure would be sufficiently great to scald persons whose duty obliges them to be about the engine, though not generally injurious to the passengers. A valve loaded by a public officer, and left by him in an enclosure under his seal, would be the most effectual security.

I am sir, with due consideration,
Your obedient servant,
Robert Hare.

FOR THE FRANKLIN JOURNAL.

ILLUSTRATION OF ATMOSPHERIC PRESSURE.

In a former number of the Journal, we gave a demonstration of the pressure of the atmosphere, illustrated by cuts; which was, no doubt, satisfactory to most, if not all of our readers. Possibly, however, to some, the subject may be rendered still more intelligible, by means of the following illustration, which we also owe to Professor Hare.

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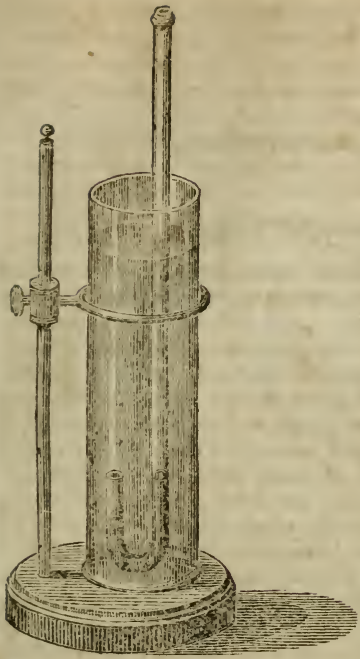
* The *Trenton* of Philadelphia, which is, I believe, the quickest boat in this, or any other country, unless excelled by another, since constructed, under the same ingenious engineers, the Messrs. Stevens.



If a tube, recurved into a crook at one end, so as to form a syphon, with legs of very unequal length, and both ends open, have the crook lowered into water, as in the adjoining figure, the fluid will, of course, rise within the tube, to the same height as without. But if, before the crook is sunk into the fluid, it be occupied by mercury, the water will enter the tube, only so far as the pressure which it exerts upon the mercury in the shorter leg of the syphon, is competent to raise the mercury in the other.

This pressure, or the effort of the water to enter the tube, is obviously measured by the height to which it forces the mercury, in the longer leg of the syphon, above the mercurial surface, in the shorter leg. The height will of course be greater, or less, in proportion to the depth to which the lower surface of the mercury may be sunk. It will also be greater or less, accordingly, as the fluid in which it is immersed, is heavier or lighter. Hence, as water is about 820 times heavier than air, a depth of 820 inches in air, would displace the mercury, as much as one inch in water.

Let us imagine a tube recurved at one end, similarly to the one represented in the preceding figure, (the crook likewise occupied by mercury) to have the upper orifice as completely above the atmosphere, as the orifice of the tube is above the water in the jar. The mercury, in the shorter leg of the syphon, thus situated, would be evidently exposed to a pressure, caused by the air, analogous to that sustained from water, in the case of the tube, as already illustrated: and this pressure of the air would, as in the case of the water, be measured by the rise of the mercury, in the longer leg of the syphon.

It is obviously impossible to realize this experiment, with a syphon, reaching above the atmosphere; but, as the only motive for giving such a height to the syphon, is, that the mercury in one of its legs may be inaccessible to atmospheric pressure, if this object can be otherwise attained, the phenomenon may be exhibited in the case of the atmosphere, without any material deviation.

In fact, to protect the mercury in one of the legs, from atmospheric pressure, we have only to seal, and fill it with mercury, before we place it in a vertical position. We shall then find, that the pressure of the air on the mercury, in the open leg of the syphon, will support a column of this metal in the other leg, of nearly thirty inches; though occasionally varying from 27 to 31 inches.

ON JAPANNING AND VARNISHING.—No. 3.

BY THE EDITOR.

To rub down, or prepare the varnished surface, for polishing.

For ordinary purposes, shell-lac varnish does not require to be rubbed down and polished, but where it is wished to have the surface very even, these processes are necessary. For rubbing down, pumice-stone, in fine powder, is used. Four or five coats of varnish, at least, must be laid on, and allowed to become perfectly hard; a piece of woolen rag may then be made wet, and a portion of the powder put upon it; this is to be rubbed carefully, and equally over every part of the varnished surface, until it appears perfectly even. Great care is requisite to avoid rubbing through at some parts, before others are rendered smooth, particularly if there are sharp edges, or projecting mouldings. When this takes place, the whole process of varnishing must be repeated; a little practice, however, will enable any one to avoid this, provided the article varnished, has an even surface, and the number of coats have been sufficient to give the requisite thickness of resin. When the surface, to be polished, is flat, the cloth may, when used, be wrapped round a piece of cork or wood; and the same method may be adopted in rubbing down mouldings.

To polish the varnish.

When the surface is well prepared by the pumice-stone, it is very easily polished. This is effected by fine rotten-stone, used exactly in the same way with the pumice-stone, excepting that sweet oil is employed, instead of water. The oil may be removed from the surface by a fine rag, and some dry rotten-stone; and if a little is then rubbed on by the palm of the hand, this will give the highest possible polish to the surface.

To prepare the rotten-stone.

Rotten-stone is sometimes harsh and gritty; the best way of trying it, is to take a little between the teeth, when the least portion of grit may be discovered. Careful workmen always wash it before they venture to use it. This is effected by stirring the fine powder in a considerable quantity of water, then allowing it to remain at rest for a few seconds, and pouring the water into a glazed earthen vessel; the powder which then precipitates will be perfectly fine and smooth; by washing the remainder, the whole of the finer parts may be separated from the grit.

The gloss upon shell-lac which has been polished, is less brilliant than that of the unpolished varnish, but this gloss may be given by a single coat of *seed-lac* varnish, which will abstract but little from the perfect surface given by polishing.

Black shell-lac varnish.

Shell-lac varnish may be rendered black, by mixing with it, either ivory, or lamp-black. The editor has frequently used, and always preferred, the latter. It should not be used as sold in the shops, being then greasy, as the workmen call it, and will neither mix or dry, well. Sometimes the lamp-black contains particles of plaster, from the walls of the chambers in which it is made; this, of course, should be rejected.

To prepare lamp-black for use.

Press a portion of it, into any earthen, or metallic vessel, which may be made red hot in the fire; for small quantities, a tobacco pipe, a piece of a gun barrel, or any other metallic tube, will answer the purpose perfectly well. It is not necessary to close the vessel, but the powder should be well rammed in; place the whole in an open fire until it is red hot throughout; this may be known by the lamp-black ceasing to flame at the exposed parts; take it from the fire, and allow it to become quite cool before you remove it from the vessel, otherwise it will burn into ashes. Lamp-black, thus prepared, will mix readily with water, will dry well in paint or varnish, and will be improved in colour.

To mix the colour with the varnish.

Rub the lamp-black up with a little alcohol, spirits of turpentine, or weak varnish, taking care to make it perfectly smooth before putting it into the cup with the varnish. To give a good black colour, the quantity of lamp-black must be considerable; this, it is true, will lessen the brilliancy of the varnish in some degree, but a thin coat of seed-lac, will diminish this fault. When only a small quantity of black varnish is wanted, it may be made by dissolving black sealing wax in alcohol. Sealing wax being composed principally of shell-lac. But little heat should be employed, or the black colour will be precipitated.

Shell-lac varnish of various colours,

May be made by mixing strong body colours, in fine powder, with the varnish, levigating them in the same manner as recommended with the lamp-black. None but full, deep colours will answer, as the colour of the varnish will deteriorate all those which possess any transparency, or which are of a light shade.

Red shell-lac varnish,

Is best made from good Dutch sealing wax. This is the kind used to varnish glass, and wood, for electrical purposes. Three or four coats will make a perfect covering.

Of the brushes used in varnishing.

It has been already remarked that the painters' sash-tool, makes a very good varnish brush for common purposes; for large articles, however, the flat camels-hair brushes, made for the purpose, are to be preferred; they are to be obtained from half an inch, to four inches in width, at most of the drug stores; for smaller sizes, round brushes, with tin tubes, are to be preferred.

It is a common practice, when the same brush is always used with the same kind of varnish, to allow it to dry with the varnish on, after scraping the brush on the edge of the cup; in this case it must be allowed to stand in the varnish for a few minutes to soften before using. It is a much better practice, however, to wash the brushes clean in spirits of turpentine, or in alcohol. When washed in the latter, the alcohol need not be wasted, but may be poured into the varnish bottle. For coloured varnishes, kept in small quantities, the brush may be left in the bottle; but in this case the cork should be perforated so as to fit the handle, and the points of the hairs should dip into the varnish; it is then always ready for use. A common mustard bottle will, in general, answer the intended purpose.

Of the French polish, by means of shell-lac varnish.

There is a mode of using shell-lac varnish, which is sometimes denominated the French, and sometimes the German mode. To whomsoever it is due, it merits to be generally known, as the process is easy and economical, and the effect beautiful. It has been much employed by cabinet and musical instrument makers, but is yet not so extensively practiced as it merits to be.

The varnish is to be prepared in the way already directed, and is used of a moderate thickness. The article to be polished must have a smooth even surface, such as is left by fine glass-paper, usually called sand-paper.

Mode of applying the varnish.

The varnish is applied by means of what is called a rubber; this is frequently made by rolling up a strip of thick woolen cloth, which has been torn off, so as to form a soft elastic edge; thick, wide list will answer perfectly well, although a greater width is more convenient to hold. The coil may be from one to three inches in diameter, according to the size of the work.

(From Gill's Technical Repository.)

" *On the manner of applying the varnish.*—The varnish, put into a narrow-mouthed bottle, is to be applied to the middle of the flat face of the rubber, by laying the rubber upon the mouth of the bottle, and quickly shaking the varnish up once; as the rubber will thus imbibe just a sufficient quantity to varnish a considerable extent of surface. The rubber must then be inclosed in a soft linen-cloth, doubled; the remainder of the cloth being gathered together at the back of the rubber, to form a handle to hold it by; and the face of the linen-cloth must be moistened with a little raw linseed oil (which may either be coloured with alkanet-root, or not,) applied with the finger to the middle of it. The work to be varnished, should be placed opposite to the light, in order that the effect of the polishing may be better seen; and a surface of from one to eight feet square may be varnished at once."

"The rubber must be quickly and lightly rubbed upon the surface of the article to be varnished, and the rubbing continued until the varnish becomes nearly dry: the coil of woolen cloth must be then again wetted with the varnish, but no more oil need be applied to the surface of the linen cloth, and the rubbing again continue till the varnish becomes nearly dry, as before: and again, a third coat must be applied, in the same manner; then one with a little oil; which must be followed, as before, with two others without oil:—and thus proceed until the varnish has acquired some thickness, which will be after a few repetitions of the series; when a little alcohol may be applied to the inside of the linen-cloth, before wetting the coil with the varnish; and then rub very quickly, lightly, and uniformly, over every part of the varnished surface, which will tend to make it even, and very much conduce to its polish. The linen-cloth must next be wetted with a little alcohol and oil, without varnish; and the varnished surface being rubbed over, with the precautions last mentioned, until it is nearly dry, the effect of the operation will be seen: and, if it be found that it is not complete, the process must be continued, with the introduction of alcohol in its turn, as directed above, until the surface becomes uniformly smooth and beautifully polished."

" *On varnishing hollow and round works.*

"In this case, the woolen-cloth is not to be used with its flat end, *but on its side;* to which the varnish must be applied, as before directed, and be covered with two folds of the linen-cloth, oiled or not, as before mentioned.

" *On varnishing recesses or carved work.*

"When this occurs in cabinet-work, &c., and where the surfaces are not liable to wear, or are difficult to reach with the rubber, a spirit-varnish, made with, or without lac, of the usual gum resins, and considerably thicker than that used in the above process, may be applied to those parts with a brush, or hair-pencil, as is commonly done in other modes of varnishing.

" *On varnishing works in the lathe.*

"This process is exceedingly easy; and does not require much more skill than the mere application of a little oil to the surface of a soft linen-cloth, and putting the lac-spirit-varnish upon it; then both together to be held upon the surface of the work, whilst turned round in the lathe, and rubbed along it, backwards and forwards, till the effect is produced."

The editor has frequently tried the *French polish*, but he has always used a kind of rubber differing from that above mentioned, it is made as follows;—a piece of thick woolen cloth, six or eight inches in diameter, is taken, upon one side of this a few teaspoonsful of the varnish is poured, the edges are then collected together, so as to enclose the varnish in the cloth, and form a handle by which to hold it; this is then covered with a piece of oiled linen cloth, and the rubber is ready for use. When requisite, more varnish may be added; it will be found necessary, occasionally, to pour a little alcohol into the cloth, when the varnish becomes too thick to ooze through.

Some difficulties may be at first experienced in performing this process, but a very little practice will enable any handy person to surmount them, and to produce a beautiful polish without using successive coats of varnish, which require considerable time to dry, and which mode is otherwise attended with much more trouble than the plan here described.

On Bronzing Plaster figures, and other articles. By the Editor.

What is called bronzing, is the giving to articles, an appearance similar to that assumed by statues, and other ornamental works, which are made of the compound of copper and tin, known under the name of bronze. In them the metallic surface becomes corroded by exposure, and in general appears of an intense green colour; whilst the more prominent parts, being most subjected to friction, retain a portion of metallic lustre.

Different modes of producing this effect, are pursued; but they all consist in covering the figure to be bronzed, either with water, or oil paint, of the desired colour, and then rubbing a metallic powder upon the projecting parts.

When water colour is used, the work must be sized over, until it will *bear out*, that is, until the moisture will stand upon the surface. and not sink immediately in. The books in general recommend size made from isinglass, but good, clear, common glue, is much cheaper. and will answer equally well. After the cast, or sculpture has been properly sized, it is ready to receive the colour; this is prepared by grinding Prussian blue, yellow ochre, and lamp black, in some weak size. The colours ought to be ground separately, and afterwards mixed together, as the Prussian blue requires more grinding than either of the others; and because they may afterwards be so mixed, as to produce any tint required. The colour must then be spread evenly over the article to be bronzed, and allowed to dry. When it is dry, dip a brush into some thin oil gold size, scrape the brush, so that but little of the size may remain in it, and pass it over the figure, so as just to moisten every part: it is then to be put by, until it becomes *tackey*, that is, until the finger will adhere to, but not be moistened by the size; it is then ready to receive the bronze powder.

When oil gold size is not at hand, a little japan varnish, or even fat oil, diluted with spirits of turpentine, will answer the purpose.

Sometimes the bronze powder is applied without the intervention of any adhesive matter, excepting the size contained in the water colour. It must then be rubbed on before the colour is perfectly dry.

To Bronze with oil colour.

First give the work a coat of white, or red lead, ground in oil, and when this is perfectly dry, apply another coat, consisting of the colours before named, ground in oil, and mixed with a small quantity of japan varnish, this is to be suffered to dry, until it becomes tackey, when the bronze powder is to be applied to it. This is the mode pursued by Mr. Meer of this city, whose bronzed figures, are beautiful specimens of this process.

On Bronze Powders.

There are various kinds of bronze powder, which are kept for sale by many of the druggists. The *aurum musuvium*, or mosaic gold, is used for inferior articles; this is a preparation of tin, quicksilver, and sulphur, possessing a bright gold-like appearance. A copper coloured bronze, may be obtained by dissolving copper in aqua-fortis, until it is saturated, and then putting into the solution some small pieces of iron, when the copper will be precipitated in the metallic state; the fluid must then be poured off, and the powder carefully washed, dried, and levigated, when it may be put by for use. Bronze powder is sometimes made from Dutch-gold, which is sold in books, at a very low price. This is treated in the same way as gold-leaf, in making the gold powder; all these inferior bronzes require to be covered with a coat of clear varnish, or they will very soon lose their metallic appearance, nor will the varnish entirely prevent, although it will greatly retard this change.

True Gold Powder.

This is prepared by taking gold-leaf, and grinding it with molasses, or honey, on a fine marble slab, or in a wedgwood mortar. It may by this means, be reduced to an extremely fine powder. The whole should then be put into a large glass jar, which must be filled with water, and the mass stirred, until the honey, or molasses is completely dissolved. It is then allowed to remain at rest until the whole of the gold has fallen to the bottom; the larger portion of the fluid may then be poured off, and more water added. This process should be repeated several times, until the water comes off perfectly pure. The powder must then be dried, and it is fit for use. It is particularly requisite to be careful that a large proportionate quantity of water be used in the first washing, otherwise the thickness of the sirop will prevent the fine powder from precipitating.

These processes are given with the double view of satisfying curiosity, and of instructing those who cannot procure the powders ready made; when they can be purchased, it is much cheaper to do this, than it is to make them.

Very excellent gold powder, of different shades of colour, is manufactured by Mr. Henry Carvill of this city.

Mode of applying the Bronze powders.

All the recipes which we have seen, direct the use of a brush, or of a piece of cotton, dipped in the powder; this mode is not only slovenly, but also wasteful, which is of some importance when gold powder is used, and no other material ought ever to be employed, as it greatly excels all its substitutes, both in durability and beauty, and when properly managed, the increased expense is trifling.

The best mode is to cover the finger with a small piece of doe-skin leather; this should be lightly dipped into the powder, and the loose particles rubbed off upon a piece of fine smooth leather, which may be pasted on a small piece of board, and kept for the purpose; or the cover of a book, will answer perfectly well. The powder may then be applied so as to touch those parts only where it is wanted, and the quantity may be regulated with the greatest exactness. A brush, or a piece of cotton, will allow particles of the powder to fall where it is not desired, and thus injure the work.

We have already said that the prominent parts only, ought to be touched with the powder. Some articles however, admit of more of the metallic covering than others. Thus a medallion, which may be supposed to be frequently handled, and consequently rubbed bright, ought to be covered more freely than a bust, or statue. It is evident that this must be left to the good sense of the workman. Varnish is not only unnecessary, but would materially injure articles, where the genuine gold powder is used.

ENGLISH PATENTS.

Specification of the Patent granted to Thomas Magrath, *of Dublin, for an improved apparatus for conducting, and containing, water and other fluids, and preserving the same from the effects of frost.* Dated January 11, 1825.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Thomas Magrath, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described, and ascertained, in the following description thereof (that is to say:) My improved apparatus for conducting and containing waters and other fluids, and preserving the same from the effects of frost, consists of a double pipe or tube of metal, the one enclosed within the other. The inner pipe or tube is to contain the water or other fluid, and to conduct it; between the two pipes or tubes I introduce charcoal, cork, wool, or any other material that is a bad, or imperfect, conductor of caloric. Under some circumstances I should use three or more pipes or tubes, one within the other, and between each of these pipes I should introduce charcoal, cork, or other imperfect conductor of caloric. Though I have described pipes or tubes one within the other as the mode for constructing my apparatus, yet it is to be understood that I only mention this as a convenient method for making the same, and one I should generally adopt; but the same may be applied in an apparatus of another form,—for instance, when the vessel containing, or conducting, water or other fluid, should be spherical, square, or any other form, I should make such vessel with a jacket or outer case, and fill the space between the two with charcoal, or other imperfect conductor of caloric. Under some circumstances I should dispense with the outer jacket or covering of metal, and adopt one of wood or other convenient material. Having thus described several modes of constructing my apparatus for preventing the freezing of water or other fluids contained therein, I must add, in conclusion, that my said improved apparatus may be varied in several other ways, and that as my invention consists in adapting a coating of any material which is a bad or imperfect conductor of caloric, to the outer surface of vessels of all kinds containing fluids, that every manner in which the same may be adapted to effect the said object, viz. preventing the freezing of fluids contained or passing through the said vessels, I consider to fall within the principles and meaning of my patent right. I therefore claim the same accordingly.

In witness whereof, &c. [*Repertory of Patent Inventions.*

Had Mr. Magrath taken out his patent in the United States, he would have disputed with us our right to surround the pipes of our hydrants with charcoal, wool, tan-bark, straw, "or any other material that is a bad or imperfect conductor of caloric;" and by a slight variation, or extension of his patent, might have ordered us to divest ourselves of our flannel jackets, and every "other material, that is a bad or imperfect conductor of caloric." If Mr. Magrath has extended his patent over England, Scotland, and Ireland, he has paid office fees to the amount of £300 sterling, for what has been known in principle, ever since men began to clothe themselves in the skins of animals; and what has for ages, been freely practised by persons of every grade, from the philosopher, to the old housewife, who has wrapped a piece of woolen-cloth round the water-pipe, or the cock of the cider-barrel, to keep their contents from freezing. [*Editor.*

Patent granted to JOHN STEPHEN LANGTON, *of Langton Juxta Partney, Lincolnshire, Esq. for an improved method of seasoning timber.* Dated August 11, 1825.

In this method of seasoning timber the pieces of it are put into a long vertical air-tight vessel or cylinder, heated externally by steam, or by a water bath, which latter may be either brought to the proper temperature in the common method, or by the use of steam. For either of these methods, the vessel or cylinder which holds the timber, must be enclosed in a second vessel, prepared so as to contain whichever of the two mediums is preferred for communicating the heat. The internal vessel is to rise a little above this enclosing vessel, and is to be closed with a cover, made air-tight, and fastened down in any convenient manner; and in its centre is to be another small lid, in which is to be fixed a mercurial syphon gage: there is also to be "*a screw*" fixed in it, by turning which a communication may be made with the external air, when the timber is to be removed. The top of the external vessel is to be covered with a flagged platform, on which those who are to put in and remove the timber are to stand; and from the part of the internal vessel which rises above this platform, a pipe, furnished with a stop-cock, is to go off sideways to a condensing vessel, below which is to be placed an air-tight vessel, for the reception of the liquor that runs from the condenser, and communicating with it by a tube; from the top of this receiving vessel a pipe ascends to an air pump, and from its bottom another pipe goes to a water pump, to be used occasionally when the vessel becomes filled with liquor, which is known by a glass tube, fixed to its upper part, which bends round at right angles, and enters into it at its two extremities.

The condensing vessel is composed of a number of vertical tubes, each having at its top, outside, a tunnel, between which and the tube, a narrow interval is to be left for the passage of water, which is to be conveyed by separate pipes to the tunnels, and to be let to trickle down the outsides of the tubes, to keep them cool. The tops of the tubes may be made to communicate with the main pipe, that leads from the timber vessel, either by separate pipes, branching off from them, or by rows of lateral pipes, into each of which a certain number of the vertical tubes are made to open. A similar set of intermediate pipes should be fixed at the bottom of the condenser, to form a communication from the lower ends of the tubes, to the pipe that leads to the receiving vessel.

The vessel or cylinder, that holds the timber, which is thirty feet or more in length, may be made of several lengths of cast iron, furnished with flanches, by which they may be fastened together air-tight with screws and nuts; and when it is to be exposed to steam alone, it should be of that strength as to be able to bear an external pressure of fifteen pounds to the square inch; but when a water bath is to be used, then the bottom of the vessel should be strong enough to bear a force of thirty pounds to the inch, and the top be of the strength before-mentioned, and all the intermediate parts should be proportionably stronger, as they are closer to the lower extremity. The bottom of this vessel should also be fastened down to the external vessel; so that if the latter be filled with water, while the former is empty, it may be prevented from rising from its place.

Small timber should be kept in the vessel twelve hours, exposed to the action of the air pump and the heat, before it is examined; very large timber will require a week to complete its desiccation, and that of intermediate sizes a time, between the two periods, proportionate to its dimensions.

The mercurial syphon gage at the top of the apparatus, will regulate the heat to be applied to the vessel, and also indicate when the operation is perfected. When it shows a depression of three inches of the mercury, the heat of the bath, or surrounding medium, is to be 130° Fahrenheit; when two inches, at a temperature of 120°; and when the mercury is depressed one inch, a heat of 112° is to be applied; but the heat in no case is to exceed 200°.

When it is desired to be known whether the timber is sufficiently exhausted of its juices, the stop-cock of the pipe, that goes to the condenser from the vessel that contains the timber, is to be closed; and if in half an hour afterwards no rise be observed in the mercury, the operation may be concluded to be completed.

The method above described, of extracting the juices from timber, appears to us to be very effectual and practicable; and if, as is generally supposed, the dry rot be principally owing to the sap liquor retained in the wood, this plan may be a means of preventing what we may consider as a national misfortune, from the great destruction it has occasioned in the vessels of the British navy of late years, and the heavy expenses caused by this calamity, at a time when the demands on the public treasury, on other accounts, were so enormous. With a view to this beneficial result, we earnestly recommend trials to be made by the patentee, or by others, of the effect of soaking timber, prepared by his method, in various compositions, particularly those of which oils, fats, or tar form a part.

We think the vertical position which the patentee has chosen for his apparatus, would occasion difficulties in the process which might be easily avoided by placing the principal vessels horizontally.

Except for fir timber, from which some spirits of turpentine might perhaps be extracted in the course of the operations proposed, it appears to us that the condensing refrigerator, and "collecting vessel" or receiver, might be omitted in the apparatus, by which a considerable expense would be saved in its erection, and the whole be made less complicated, without its efficacy being materially diminished.

[*Repertory of Patent Inventions.*

On improved Melting Pots, for Cast-Iron and Brass. By Mr. L. Anstey, *Cast-Iron Founder; with the manner of using them, and a description of his Wind-Furnace.*

From the Transactions of the Society for the Encouragement of Arts, Manufactures and Commerce.

Sir,—I herewith send a melting-pot of my manufacture, which, from several years' experience in the melting of cast-iron, I find to answer the purpose better than any which I have been enabled to procure. They are composed of two parts Stourbridge clay, and one part of the hardest coke, well ground and tempered together. Any further explanation I should be happy to give, if required.

I am, sir, &c. &c. &c.

A. Aikin, *Esq. Secretary, &c. &c.* L. Anstey.

The following particulars were stated by the Candidate, to the Committee.

The composition employed by him is the following:—Take two parts of fine ground raw Stourbridge clay, and one part of the hardest *gas* coke, previously pulverized and sifted through a sieve of one-eighth of an inch mesh. Mix the ingredients together with the proper quantity of water, and tread the mass well (if the coke is ground fine the pots are very apt to crack.) The pot is moulded by hand upon a wooden block, made in the form which its inside is intended to have; this core is fixed upon a pin so that it may be turned round, and a gage to regulate the thickness of the pot, is placed upon a frame made for that purpose. The core is covered with a cap of linen, or cotton, which after being wetted is placed upon it before the clay is put on, in order to prevent the pot from sticking, when it is to be taken off. When removed the inside is made smooth, a lip formed for pouring out the melted metal, and the pot carefully dried by a gentle heat.

The smaller pots hold about twenty pounds of cast-iron, and can be afforded for ten pence a-piece; the larger ones hold forty pounds, and may be afforded for fourteen pence.

A pot, dried as above, when wanted for use, is first warmed by the fire-side, and is then laid in the furnace with the mouth downwards (the red cokes being previously covered with cold ones, in order to damp the fire;) more coke is then thrown in, till the pot is covered, and it is then brought gradually up to a red heat. The pot is then turned, and fixed in its proper position in the furnace, without being allowed to cool, and is then charged with cold iron, so that the metal, when melted, shall have its surface a little below the mouth of the pot. The iron is melted in about an hour and a half, and no flux or addition of any kind is used. A pot will last for fourteen or even eighteen successive fusions, provided it is not allowed in the intervals to cool; but if it cools it probably cracks. These pots will bear a higher heat than others without softening, and will consequently deliver the iron in a more fluid state than the best Birmingham pots will.

The cavity of the furnace employed by the candidate is eleven inches square in superficial area, and consists in depth of eleven rows of bricks, made of Stourbridge clay; the wind hole is four inches square, and is placed three inches below the top; the bars are either of wrought or cast iron, supported on wrought iron bearers. The ash-hole is ten courses of bricks below the bars, and the chimney is rather a high one. The sides of the furnace wear away by the heat, so that in the first week the cavity becomes two inches wider than at first. It is then brought up to its original width, by a lining of glass-cutters' mud, which consists of fine sand mixed with particles of glass; and this is renewed twice a week. The cavity of the furnace being only eleven inches across, and seven inches of that being occupied by the melting pot, it is of course necessary that the coke used as fuel should be broken into small pieces, not larger than a walnut.

At a subsequent meeting of the committee, D. Campbell, Esq. who had been requested to make some experiments on Mr. Anstey's pots, reported that he had melted a charge of iron in one of the smaller pots, placed in a powerful wind furnace; the pot remained sound.

Into a second pot was put a Wedgewood crucible, inclosing a black-lead one, and that a Cornish one; a cover was luted on, and the pot thus charged was kept for three hours in the same wind-furnace, and was brought unopened to the committee. On examination, Anstey's pot appeared to be quite entire; its shape had not altered, nor was there any change of texture, indicating an approach to fusion; it resisted several blows of a hammer before it broke. Of the crucibles inclosed in the pot, Wedgewood's had cracked to pieces, and the texture had softened considerably, and had undergone a change of shape; the Cornish one was unaltered in shape, and nearly so in texture, having only become somewhat more compact.

A third pot had been exposed for an hour to a very high heat in the same furnace, being placed on a brick of Stourbridge clay; several small crucibles had been put into it, and a cover had been luted on. On examination, the pot had undergone no change, except that the slag of the coke, which was used as fuel, had glazed it over: beneath the glaze there were no signs of fusion, nor even any change of texture. The brick support was in the state of porcelain jasper; the cover had begun to sink in: the Cornish crucible which was inclosed showed a beginning of fusion; the Chelsea crucible was bubbly, and half melted.

An empty five-inch real Hessian crucible had been heated in the same furnace as strongly as possible: it had not sunk down at all; on being broken the texture appeared porcellaneous, with interspersed air bubbles, showing a beginning of fusion.

A white Birmingham pot was first annealed, and then heated (empty) in the same furnace. On examination by the committee, it was found to be cracked across the bottom, and its texture had become that of porous porcelain jasper.

Another white Birmingham pot was treated in the same manner as the former, and on examination presented several small cracks, and a porcellaneous texture, but less porous than the preceding.

One of Anstey's large pots, in which, five charges of iron had been melted, was shown to the committee; the form was unaltered; it withstood several blows of a hammer before it broke; the texture was granular, without any commencement of porcellaneous appearance.

Additional Observations. By Mr. GILL.

When it is stated in the above account, that Mr. Anstey's chimney "is *rather a high one*," it must not be understood as being a *very lofty* one: indeed it was not higher than the ordinary chimney of a house of three stories; and the upper part of it, for seven or eight feet, was formed of a thick sheet iron cylindrical pipe riveted together.

The internal lining of Stourbridge bricks in his furnace was made to be renewable from time to time, as it became burnt through in use: and with this view it was not united with the external walls of the furnace, but laid in, without any Stourbridge clay or mortar being interposed between the said lining and the furnace walls.

His furnace was, at first, built on the side of his workshop, adjoining to an old rivulet; and in consequence of the *damp air* arising therefrom, he was not able to bring his heats to a sufficient height. He was therefore under the necessity of removing it to the opposite side of the workshop, where, the air being drier, he could obtain the desired result. This is a curious fact, and proves, that although for *moderate heats* a *damp air* is sufficient, and indeed is generally preferred, yet for the *intense heat* required to bring *cast-iron to a proper degree of fluidity* a dry air is requisite.

Mr. Anstey found his melting pots to wear away around their mouths, owing to the oxide of iron falling upon them from the broken pigs of cast-iron with which they were charged, and fluxing them. Had it not been for this misfortune, they would have borne a much greater number of fusions to have been made in them.

Mr. Anstey uses the *gas*-coke as fuel in his furnace, as well as for mixing with the Stourbridge clay, to form his melting pots.

He is in the practice of casting many small articles in cast-iron, and afterwards annealing or decarbonating them, by cementing them at a high red heat for a considerable length of time, say a fortnight or more, surrounded by a mixture of powdered hæmatite, and other ingredients, by which they are rendered tough and malleable, or brought to a state nearly resembling wrought-iron, and at a rate much less than they could be afforded for by forging them; and, indeed, when we consider their *perfect soundness*, arising from *casting them*, over the casualties of forging and *welding wrought-iron*, we conceive that, for many purposes, these decarbonated cast-iron articles, are even preferable to those made of wrought-iron.

On improved Melting-pots for Brass, &c. to withstand the action of Fluxes.

On lately mentioning to an intelligent workman in brass, pinchbeck, gilding metal, &c. and who is also a maker of spelter solders, the melting-pots for cast-iron made by Mr. Anstey, he said they might answer very well for cast-iron, but would not serve by any means for alloys of copper and zinc, nor where fluxes were used, by reason of their *porosity*.

He stated, that he found it necessary to form his own melting-pots of one half new Stourbridge clay, one quarter of broken melting-pots, one eighth of hard coke, and (for the purpose of closing the pores) one eighth part of pipe-clay.

He also, *for the sake of giving them a greater degree of compactness*, adopted the excellent plan recommended by the celebrated Glauber; namely, that of *forming them in metal moulds, strongly compressed by the action of a screw-press.*

He said that provided they were kept continually hot, his melting-pots would serve for a fortnight, and neither zinc, nor fluxes, would make their way through them.

In making his alloys of copper, and zinc, he first melts his copper, covered with a flux of common salt or nitre, and then thrusts the zinc down below the surface of the melted copper, and he thus avoids the loss of the zinc from its oxidation. [*Technical Repository.*

ON ENGRAVING.

(From the Mechanics' Gallery. By C. F. Partington.)

(Continued from p. 69.)

On Machine Ruling, and Engraving in Chalk.

We must here mention, as one of the most signal improvements which has been made in the art of etching since its first discovery, the use of machinery to draw the lines upon the etching ground. All kinds of mathematical and mechanical designs, consist almost entirely of straight lines and regular curves, the whole of which can be drawn by machinery with a precision that the eye and hand can never equal. Lowry appears to have been the first who used machines in this way, and his performances are truly admirable. Machines for ruling equidistant lines, both straight and waved, are now commonly made in London; they consist of a straight bar of brass or steel, upon which slides a socket, with a steady but easy motion. To the side of the socket is fitted a perpendicular tube, which receives a steel wire, or any other hard substance called the pen. This pen has a point like an etching needle, and it is pressed down by the action of a spring. If then a copper-plate covered with the etching ground, be placed under the ruler, which should be supported at each end and raised about an inch above it, the point of the pen may be caused to reach it; and if the socket to which the pen is attached, be drawn along the bar, it will form a straight line upon the plate, more even, but in other respects the same as if that line had been drawn by hand with a ruler. Now if the plate or the ruler, after a line is drawn, be moved backwards or forwards, in a direction parallel to this first line, any number of lines may be drawn in the same manner, and a design consisting only of straight lines might be entirely completed. In the machines, therefore, a very exact screw, acting upon a box confined by a slide and connected with the bar, or the board upon which the plate rests, produces the requisite motion; and a contrivance or index is used to measure the exact portion of a turn required, before any stroke is drawn. Such is the principle of the machine most generally used; those for drawing curves, are adapted to the wants of particular engravers, and have hitherto been made under their own inspection. One remark, however, applies to them all; the point or pen employed should not be made of steel, which, however well tempered, will require frequent whetting, and must therefore inevitably draw strokes deficient in perfect uniformity. The pen should have a diamond point, which, when once properly figured, remains constantly the same, and imparts an admirable degree of regularity and sweetness to the work.*

Engraving to imitate chalk drawings has lately, very deservedly, merited public attention, by the beauty of many specimens it has produced. It may be considered as a method of etching in dots, since the preparation of the plate, laying the ground, tracing the subject, &c. is the same as in etching. The principal difference is, that instead of lines, as in etching, the drawing, shadows, &c. consist of a mixture of varied, and irregular dots, as freely as can possibly be done, yet carefully, and made more or less soft, so as to resemble the grain produced by the chalk on paper. For every stroke of the chalk may be considered as an infinite number of adjoining points, which are the small eminences of the grain of the paper, touched by the chalk in passing over it. The plate being prepared, and the ground laid, as in etching, the drawing to be imitated may be counterproved on the ground of the plate. If this cannot conveniently be done, black-lead pencil, or red-chalk, must be applied to varnished, or oiled-paper; by which means all the traces of the drawing may be transferred to the ground. The outlines of the drawing must be formed in the etching by points, which will create dots, whose size and distances must be determined by the quality of the strokes of the original drawing. In forming the lights and shades, it is necessary to distinguish between those hatches which serve to express the perspective of the object, and those which form the ground thereof. The principal hatches must be more strongly marked; the middle tints (if etched) marked lightly, or they may be left to be finished by the dry needle, and graver, after the ground is taken off, which will give them a greater degree of softness. In applying the aqua fortis, the artist should be careful not to corrode the lighter parts too much. When these parts are sufficiently bitten, they may be stopped up with the turpentine-varnish and lamp-black; and the aqua fortis may be applied again to bite the stronger parts; and it may be observed, that if the dots which compose the shade, burst into each other, it will not injure the work, except they form too hard a spot, or too considerable a black. When the ground is taken off the plate, it will be necessary to interstipple, with proper points, in the flesh, and softer parts of the work, which will produce a more delicate effect than can ever be attained with the aqua fortis alone: the strongest shade will also require additional strength, and must, therefore, be deepened by slight strokes of the graver. The graver is the only tool that can be depended upon in finishing small subjects which require neatness. The best manner of preparing it is, by changing its situation in the handle so that the belly part of it, which was lowermost, becomes uppermost; then, by turning the handle in the hand, the point acts upon the copper from a greater elevation, which is preferable; as dots only, and not strokes, are required, the tool is managed in this position with much greater ease and freedom. This part of the operation consists only in covering the copper with dots, in a manner, lighter or heavier, proportionate to the colour required. When one covering of dots is scraped off, another must be inserted, and so on; by this repetition a proper grain, and sufficient masses of shade are procured. Though the process is tedious, it requires no very great skill in the artist: care, attention, and practice will enable him to succeed.

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* A very perfect machine of this kind will be figured and described in this Journal. It is the invention of Mr. Asa Spencer; and was, in London, preferred to Mr. Lowry's ruling machine.

This species of engraving admits of greater variety in the mode of executing it, than either etching or engraving with the tool. Of those who profess it, every one has a peculiar method of performing some particular part. In large subjects, and also in those where a general effect only is wanted, and great exactness is not required, some persons use various tools for facilitating their work, such as wheels having single or double rows of teeth at their edges, cradles resembling a mezzotinto grounding-tool (but made with teeth,) and sometimes others constructed according to their own minds: but these tools, though more expeditious than the graver, seldom produce a very good effect, and can never be depended upon, in any degree, for accuracy or neatness. They are, however, much used by the French engravers in chalks. Indeed this part of the art was first invented in France, and is still performed with good success in that country. Their set of tools for this purpose, amounts in the whole, when perfect, to near 40 articles: and it must be confessed, that the productions of the French engravers very often more nearly resemble original drawings in chalks, than the engraving of the English finished solely with the graver: but, on the other hand, the English productions in this line are universally allowed, by every country in Europe, to possess a certain neatness, accuracy, and mellowness of style, which are sought for in vain in the chalk-engravings of our rival neighbours.

It will sometimes happen, particularly to him who is not well practised in the art, that those parts which were intended to be dark, fail in their proposed effect, which is sometimes the fault of the tool, the ground, or the aqua fortis, but more frequently the inexperience of the artist. When this is the case, the plate may be re-bitten by heating it, and, at a convenient part thereof, melting a quantity of ground, and, with a dabber, carefully, by degrees, transplanting it, by beating it gently to the parts proposed, so that the surface only of the copper may be covered, and the hollows or excavations of the work may be free and clean. When the plate is cold it may be re-bitten with aqua fortis as before. It is adviseable not to smoke it in this operation, lest the heat of the candle, or lamp, melt the ground into the work. This method of re-biting the work is used not only in engraving in chalks, but in every species of engraving in which aqua fortis is used, and in every kind of etching, and is among the secrets of the superior engravers.

To clean engraved strokes, they should be washed with a little spirit of turpentine; if the dirt is of long standing, soap-lees poured on the plate while it is heating will be very effectual in clearing away the dirt. But it must be immediately washed off with plenty of cold water, otherwise it will injure the work; it is also too strong for mezzotinto plates, unless used very carefully, and not suffered to continue long on the plate.

The chief merit of engraving in chalks is to form a kind of deception, which, when well executed, it does very successfully, so that the connoisseur is hardly able, on the first inspection, to distinguish between the original drawing and the engraving made in imitation of it. It is extremely useful, as it serves to multiply copies of drawings left by those masters who excelled in the use of chalks, and furnishes young artists with the same assistance in the practice of drawing as if they had access to the original. Drawing also made with chalks of different colours may be imitated in this manner, if a plate be provided for every colour. The French have very well imitated drawings on blue paper, by using two plates, one of which printed the black chalk effect, the other that of the white chalk. Chalk-plates, likewise, printed in black, on blue paper, may afterwards be touched with white chalk, whereby they will have a very pleasing effect.

(TO BE CONTINUED.)

On obtaining Early Crops of Peas. By THOMAS ANDREW KNIGHT, *Esq. F. R. S. President of the London Horticultural Society.*

Considering even trivial improvements to be important, relative to the management of those species of plants, upon the culture of which much labour and capital are annually expended, for private use and for the supply of the public markets, I address to the Horticultural Society, the following *account of a mode of obtaining an early crop of peas*, which I have practised with great success in the present spring.

When severe winters have proved fatal to crops of peas sowed in the preceding autumn, many gardeners have experienced the advantages of raising other plants in pots, with artificial heat, early in the spring, and subsequently transplanting them into the common soil; and the object of the present communication is only to describe an improvement in the mode of repeating this operation.

In the present spring, my garden, owing to its soil being cold, and the climate rather inhospitable, did not contain, in the end of February, a single living pea-plant: and I purposely delayed the experiment, which I proceed to relate, till the first day of March. Upon that day the ground was prepared, and part of the seed sown, as usual, in rows, where the plants were to remain; at the same time other peas, of the same early kind, were sown in circles within the circumference of pots of ten inches in diameter, inside measure. These pots were nearly filled with a compost of a peculiar kind, from the highly nutritive and stimulating qualities of which I anticipated much acceleration in the growth of my plants, with the advantages of being able to remove them, at the proper period, to the open ground, without having their roots at all detached from their pasture, owing to the fibrous organic texture of the compost. This was made of equal parts of thin turf, to which much lifeless herbage was attached, and unfermented horse-dung, without litter; and a quantity of the ashes of burnt weeds, containing, as usual, a good deal of burnt mould, equivalent in bulk to about one-twelfth of the other materials. Equal parts of fresh soil, with unfermented horse-dung, with litter, and a small quantity of quick-lime, or wood-ashes, would probably operate as powerfully as the compost above described. The whole was reduced to small fragments, and well-intermixed; and the pots were filled with it within an inch of their tops. The peas were then sown upon the surface of the compost, and covered with common mould; and the pots were placed in my peach-house. In this they remained till the plants were an inch high, when they were removed into the open air; but they were protected during the night, for some time, and particularly when the character of the evening indicated the probability of frost.

In the last week of March the plants were taken from the pots, and planted in rows in the open ground; and I have the satisfaction to observe, that very nearly the whole of the compost adhered firmly to their roots; and that their growth subsequently was not apparently checked, in any degree, by their transplantation. They were placed in rows contiguous to those which had been previously sown, a small quantity of compost, similar to that put into the pots, being added; and the common mould was then closed round their roots, and raised upon each side of the rows. Sticks to support and protect the plants were immediately added, in rather more than the ordinary number and quantity; and subsequently no particular care, or attention, was paid to them.

On the morning of the 29th of April, I ascertained the comparative growth of my plants, which had been subjected to the different modes of treatment above mentioned, in two rows which grew contiguous to each other; when I found the height of those which had been raised in pots to be fifteen inches, and that of the others to be scarcely four inches; and I much doubt whether I ever possessed, in the most favourable season, as forward a crop of peas as my garden now contains.

Many causes appear to me to have operated in conjunction to produce the foregoing effects. It has long been known that snow does not, in winter, lie so long upon ground, which has been manured in the same season with fresh unfermented horse dung, as upon unmanured ground; and therefore I conclude that some degree of heat existed in, and emanated from, the compost, though probably never in a sufficient degree to have been sensible to the touch of any warm-blooded animal. If placed in a considerable heap, such a compost as that described, and even when the horse dung is much less in quantity, will heat violently. I have often suffered the compost of this kind, which I employ for pine apples, to become hot to prevent the subsequent appearance of earth-worms in it.

If heat was in any degree generated by the compost in which the peas grew, the escape of it was necessarily retarded by the numerous sticks by which the ground was partially covered; and little injury could have been sustained from the shade of those, because the quantity of light, comparatively with the temperature of the air, and growth of the plants, is very great after the vernal equinox; and it is every day increasing in power and influence.

Another cause of the rapid growth of the transplanted peas, has probably been the very favourable state of the soil in which they have been placed, it having been turned over with the spade immediately before transplantation took place; for peas never thrive well in strong soils, when such have been compressed and soddened, in early spring, by much moisture. But the chief causes of their very rapid growth, have, I believe, been the highly nutritive and stimulating quality of the compost, and the presence of some degree of additional warmth. For I have in former seasons derived great advantage from placing a moderate quantity of nearly similar compost immediately under rows of peas, which have been sown in the usual manner; except that the seeds were placed upon the surface of the soil, within which the compost had been buried, and covered by having had the soil collected from each side to form a ridge over them. In all cases where a compost of the kind I have described is employed to accelerate the growth of dwarfish and early peas, it should be used in small quantities only; that the early growth of the plants may be promoted, without excessive, and consequently injurious, luxuriance being given. For transplanted peas, I should prefer a poor and light soil; so that the roots might be led, as they would be under such circumstances, to confine themselves to narrow limits: and the plants consequently be brought to an early maturity.

Note by the Secretary.

In a letter received from Mr. Knight, dated the 27th of June, he mentions that he had then seen the full result of his experiment on the mode of raising early peas, above described. The plants so treated had produced a very abundant crop at least twelve days earlier than those sown at the same time in the usual way, and with a much more rapid succession of produce.

On the Mineral History of Gold, and the separation of it from Earthy and Stony Bodies, by Water, Mercury, &c. By the late William Lewis, M. D.

(Continued from p. 81.)

There are sundry European rivers which roll particles of gold with their sands in no great quantity, yet such, that the neigbouring inhabitants, at certain seasons, find their account in collecting them. M. de Reaumur, in an essay in the French Memoirs for 1718, drawn up from materials furnished by the intendants of the several provinces, in pursuance of the orders of the Duke of Orleans, gives an account of ten rivers or rivulets in the territories of France, that have gold mixed with their sands in certain parts of their course: the Rhine, from Brisac down to Strasburg, sparingly; from thence to Philipsburg, more abundantly; and most of all so between Fort Louis and Germesheim. The Rhone, in the Pais de Gex, from the conflux of the Arve, from which it is supposed to receive its gold, to about five leagues lower down: the rivulets of Ferriet and Benagues, which rise from the heights on the left hand of the descent from Varilhere to Palmiers: the Ariege, *aurigera*, about Palmiers, below where it receives the two foregoing rivulets: the Garonne, some leagues from Toulouse, below where it receives the Ariege: the Salat, which rises, as the Ariege, in the Pyrennees: the Ceze and Gardon, which come from the Cevennes, and the Doux, in the Franche-Compte. The last of these rivers is the poorest, the gold having hitherto been collected from it rather in the way of curiosity than with a lucrative view: the greatest quantities are obtained from the Rhine, not that this is really the richest, but on account of its sands being the most industriously searched; for some of the others, particularly the Ceze and Gardon, appear to be at least equal to it in richness. The quantity got from the Rhine, in an account of near two leagues below Strasburg, is said to amount to no more than four or five ounces in a year: this is the quantity brought to the magistrates of Strasburg, who farm out the right of collecting it, on condition of its being sold to them, at a price considerably under its value; so that it may be presumed that a part is otherwise disposed of, and that the quantity really obtained, is considerably greater.

There are many other rivers reported to yield gold; as the Tagus, the Danube, the Elbe, the Oder, the Inn, the Sala, &c. The Schwartz, in the county of Schwartzburg, in Upper Saxony, is said to be rich in this metal, and its sands to be worked with great profit: Stahl mentions a piece found in it, as broad as a middling bean, though not so thick, and supposes that the Sala receives all its gold from this river; the gold of the Sala being found only below where the Schwartz enters it, and being less plentiful, and in smaller grains. It is generally reckoned that the gold particles, in all auriferous rivers, are washed out by the stream from such rich beds, and afterwards rest or settle where the current is languid, or in places where they escape its force: from what particular sources the gold in different rivers proceeds, does not seem to have been examined.

The richest parts of rivers, within the extent in which they roll gold, are those where their course is slow and uninterrupted, where they widen or change their direction: the most favourable season is when the water has subsided after a flood. The appearance of the sand affords a useful mark of distinguishing the richest spots; the gold being always most plentiful where the sand is reddish or blackish, or of a colour somewhat different from what it is seen elsewhere; not that the red or black sands have any natural connexion with the gold, but on account of their being more ponderous than the white; so that the same cause which determines the particles of gold, determines these also, to subside. The black sand abounds with iron, being vigorously attracted by the magnet; the red, viewed in a microscope, appears, as Reaumur observes, a beautiful congeries of coloured crystals, imitating all the gems known to the jeweller, among which, those of the ruby and hyacinth tints are the most common; whence the reddish colour of the sand to the naked eye: the particles of gold are of irregular figures, but constantly flat, smooth, and with the edges rounded off.

Some gold has been discovered in Britain at different times, though, hitherto, in little quantity. Instances are mentioned in Houghton's Collections, from Camden, Sibbald, and Gerard de Malines, of gold found in Scotland, about the head of the Clyde, in Crawford-moor; and Boyle says, he had from some part of Scotland, divers large grains of gold, taken up near the surface of the earth, over a lead mine; one of which, clear from spar, weighed two hundred and one grains. Mr. Boyle had also an English tin ore, wherein there lay, in little cells, a number of small leaves or chips of gold: he observes, that, though the tinmen, unable to separate them to profit, usually melted both metals together, yet he was assured, that one person advantageously employed his children to pick out the gold from the ore, skilfully broken. Some earlier writers also mention gold found in the tin ores of Cornwall; and about the beginning of the present century (1700) a patent is said to have been obtained "for separating gold and silver from tin, by precipitation in a reverberatory furnace, with some peculiar fluxes:" what success this scheme met with, I have not learnt. Mr. Borlase, in his natural history of Cornwall, gives an account of some tin ore, abounding with a yellow matter, which was taken by the workmen for mundic: some bits of the yellow matter, one of which was a vein, as large as a goose quill, included in a stone, the size of a walnut, produced on being melted an ounce of pure gold: he mentions several other pieces of considerable bulk, and gives a figure of one found in 1756, weighing three hundred and seventy-six grains. It is supposed to be chiefly the stream tin, (that is, the tin ore found in detached pieces on the sides of hills,) which contains gold; that all of this sort contains more or less of it; and that both the gold and tin ore have been brought from elsewhere by torrents of water, and deposited where they are now found, like the gold sands of rivers.

Boyle conjectures that, besides the grains of gold which lie detached among sands, there may be many particles so minute, and closely fixed to the sand, as not to be perceivable by the eye, or separable by the common methods of washing or picking; that many small portions of the metal may be incorporated also with the body of the sand, and that by skilful management they might be extracted. Experiments, he says, confirmed him in this persuasion: later experiments have verified it, and shown the existence of gold in sands, to be even more extensive than he seems to have apprehended. Many of the common sands, particularly the yellow, red, black, and those of a black colour inclining to violet, appear to be rich in gold: Becher and Cramer presume that there is no sand in nature entirely free from it. Hellot relates, that in eleven assays of one kind of sand, made by M. Lieberecht, by a process described in the sequel, the yield of noble metal turned out constantly from 840 to 844 grains on the quintal, or 921, 600 grains, exclusive of what remained in the scoriæ, which were still found to be rich; that different parcels of sand, taken up at no great distance from one another, differed in degree of richness, some having afforded above 1000 grains, others only 350, and others yielding none by the treatment which had succeeded so well for the rest; and that of the metal thus obtained from sands, two-thirds are commonly gold, and the rest silver. Yet, notwithstanding the great richness of these sands, no means have hitherto been discovered of availing ourselves of the metal they contain, or of extracting it to advantage in the large way. Becher, indeed, undertook to obtain gold with profit from the common sea sands, and entered into engagements with the states of Holland, for establishing a mineral work on this foundation; but though experiments made on little quantities, promised very considerable gain, and though on trial in the large, is likewise said to have proved successful, yet, as he communicated the whole process to the commissioners appointed to examine the affair, and, as he has shown, that such a work might be carried on more advantageously in Holland than in other parts of Europe, its never having been prosecuted in Holland, affords a strong presumption of its not being sufficiently lucrative. The existence of gold in sands, is, nevertheless, an interesting fact, at least to the philosopher; and further examination may, perhaps, find means of making it turn to account.

Though gold has been but lately discovered, or expected in these minerals, in which it is so common and so plentiful, their unpromising appearance having given little encouragement to examine them, there are others, whose flattering colour has raised great expectations, but which have not been found, upon experiment, to yield any gold. The yellow pyritæ. or marcasites, and other minerals of a golden colour, or containing gold-coloured specks, have, by some, been regarded as ores or matrices of gold, and accordingly submitted to operations as fruitless as expensive: their losing their colour in the fire, or changing it to a yellow, soon discovers that their tinging matter is not gold, but sulphur, or a ferruginous calx. There are, indeed, pyritæ which contain gold, and in quantity sufficient to deserve notice. Henckel, in the 12th chapter of his *pyritologia*, gives an account of some assays of minerals of this kind, brought from the Hungarian mines, one of which yielded on the centner, or 1600 ounces, half an ounce of noble metal, of which one-fifth was gold, and the rest silver: from the same quantity of another, he obtained no less than sixty ounces of silver, and eight ounces and a half of gold: but the gold, as he observes, is by no means proper to the pyrites, or an essential part of its composition, having been only casually intermixed, as it is in stones and other minerals, in the gold mines.

Many have been deceived also, by some of the talcs: of which there is one species, naturally of a gray colour, which in a moderately strong fire, changes to a gold yellow; and another, naturally of a glittering gold colour, which receives no change from moderate fire: both these bodies have a further resemblance to gold, in imparting a deep yellow tincture to strong *aqua-regia*. By repeated digestion in fresh *aqua-regis* all the colouring matter may be extracted, and the earthy part left white; but the solution yields no gold, and is found to be no other than a solution of iron. Reaumur observes, that spangles of the yellow talc are frequent in the sands of some rivers, and that they may readily be distinguished from gold, which they have often been taken for, by viewing them with a magnifying glass; the gold particles found in rivers being constantly smooth, with the edges rounded, while the talky ones, are rugged and sharp-edged.

[TO BE CONTINUED.]

FROM THE GLASGOW MECHANICS' MAGAZINE.

ESSAYS ON BLEACHING.

By JAMES RENNIE, A. M. Lecturer on Philosophy, &c. &c. London.

No. I.

History of the Art.

SECTION I.

Bleaching may be defined, the art of whitening cloth, and other articles of manufacture, by depriving them of such colouring materials as shall naturally or accidentally adhere to them. The slightest acquaintance with the operations and instruments of this art, will be sufficient to show that it has little dependence on mechanical principles, and that it is almost wholly to be referred to those of chemistry. In an inquiry, therefore, into the improvements which have been made in bleaching, it will be necessary to bear this in mind in explaining the modes of operation, and accounting for the changes produced by the agents which are employed. From this view of the subject it will be evident, that it opens an extensive field for scientific discussion and research, in which the general scholar may receive much interesting knowledge, and the manufacturer, important and indispensable information. The Essay will be most naturally and conveniently arranged, by treating, first, of the history of the art; then, considering the apparatus, the agents, the substances to be operated upon, and the processes, in their order; and lastly, by examining the theories of the art which have been proposed.

Our knowledge of the arts exercised in the earlier ages of the world, must always be scanty and imperfect, as the records which contain the narrative of wars, revolutions, and the extraordinary phenomena of nature, are employed with matters of too high import, to descend to delineations of the peaceful arts exercised in the calm of domestic privacy. In the infancy of letters also, men of genius were either poets, historians or lawgivers, and none thought the arts of sufficient interest to engage their attention. All our information, therefore, of the arts of antiquity, must be derived from the writings of those three classes of authors, and must consist chiefly of incidental circumstances, and allusions which they may happen to mention.

The earliest writings which have been preserved, contain such circumstances and allusions as leave no doubt that the manufacture of cloth was understood in the time of their authors. In Job, which is considered to be the most ancient book now extant, there is a very striking illustration of the transitory nature of human life, taken from this art, and the very allusion indicates that it was practised with much expedition: "My days," says he, "are swifter than a weaver's shuttle." So early also as the time of Abraham, some kind of tape or inkle seems to have been made, if the passage, "I will not take a thread even from a shoe-latchet," is properly rendered. That the manufacture of cloth in the East was in a considerable state of advancement at an early period, appears also from the circumstance that veils were worn by the women as at present. For example, Abimelech says to Sarah that Abraham was to her a "covering of the eyes:" Rebekah also covered herself with "a veil" when she first saw Isaac. "Fine linen" is mentioned in the book of Genesis as a part of the courtly ornaments which Pharaoh bestowed upon Joseph; and, it may be inferred from this, that the Egyptians used flax, in preference to cotton, or any other material, as an article of dress. Wool was prohibited on account, as Ezekiel says, "of its causing sweat," and not only so, but the Egyptians held "every *shepherd* in abomination." (Gen. xlvi. 34.) A mixture also of woolen and linen, was forbid by the Mosaic law, (Deut. xxii. 11.) and probably for the same reason.

We find also that "fine twined linen" is very frequently mentioned by Moses in the decorations of the tabernacle, and commanded for the vestments of the Levites. Ezekiel mentions "linen bonnets for the head, and linen breeches for the loins." But we are not entirely left to conjecture, concerning the "fine linen of Egypt," as we possess specimens of it, which, although injured by time, are still sufficiently preserved to show its texture; I refer to that which enwraps the Egyptian mummies, and of which specimens may be seen in the Hunterian Museum. In an account of a mummy, in vol. 54 of the Philosophical Transactions, Dr. Hadley says, that when the outward painted covering was removed, nothing was to be seen but linen fillets which enclosed the whole mummy, the uppermost of which were of a degree of fineness equal to what is sold in the shops under the name of long lawn, and the weaving seemed to have been executed in the manner of Russian sheeting. This mummy was taken from the catacombs of Cairo. The mummy of an Ibis in the London Museum, which I examined with some attention, was wrapped in linen of a dark brown colour, and of a very open fabric, similar to what we denominate gauze. The threads were very even and uniform, and the distance between them seemed to be mathematically exact; so far as I could judge, it seemed to have been wrought in what our mechanics would call a 600 reed, that is, 600 threads of warp to the yard. This sufficiently shows that the Egyptians were considerably advanced in the art of making linen at a very early period, as the chronology of the mummies is by all accounts of great antiquity. The invention itself is ascribed to one of their kings. (Clem. Alex. Strom. I. 225.) We know farther, that the manufacture must have been extensive, as it was made an article of export, and the crops of flax which yielded, according to Pliny, (xix. 1.) four sorts of linen, are mentioned in conjunction with those of barley, in the account given by Moses of the plagues of Egypt.

But although we find many notices both in the Jewish and Heathen antiquities, of the manufacture of linen cloth, there are extremely few of any of the processes used for finishing it by washing or bleaching. In the time of Job, the different qualities of water, as to its power of cleansing, seem to have been known, if we do not consider the passage, "though I wash myself with snow-water," to have merely an emblematical reference to the whiteness of snow, rather than to the properties of the water. The prophet Malachi uses a figure, however, which leads us to believe that some method of whitening cloth was used in his time. He compares the scrutiny which Jehovah makes into the affairs of men, to "the refiner's fire and *fuller's soap*." Borith and the best commentators are of opinion that this "soap" was the natron at present used for the purposes of bleaching, in several countries in the East: of which Dr. F. Buchanan gives some account in the first volume of his journey to Madras. In the Apocalypse, "fine linen, clean and *white*," is made an emblem of righteousness and purity, and in the same book, "white raiment" is mentioned in conjunction with "gold tried in the fire," intimating that it had undergone some analogous process of purification.

Before the Apocalypse was written, however, we know that bleaching was practised by the Romans, and in all probability they would derive it from some of the nations more advanced in refinement than themselves. This conjecture is rendered the more probable, that the use of linen was regarded by many of the Romans as an unpardonable luxury, and those who piqued themselves upon preserving the ancient severity and simplicity of manners, boasted that they had never degraded themselves by such effeminate apparel. Indeed it is not unlikely that in this, as in most other arts, they had the Greeks for their masters, who, we know, had some method of bleaching by means of lime. This we learn from Theophrastus, who wrote 300 years before Christ. He relates that a ship loaded with linen and *lime for bleaching it,* was destroyed by the accidental access of water to the lime. It may be inferred from this, that they used the lime in a caustic state, and not as a simple earth, as this cargo must have consisted of burnt limestone, for the water to have rendered it capable of destroying the vessel.

But however ignorant we may be of the processes followed by the nations of antiquity for whitening their linen and cotton garments, we are sure that they did employ some efficient mode. For the wrappings of the mummy in the Hunterian Museum, injured as they must be by time, are much whiter than any unbleached linen with which we are acquainted. The fairest specimens are of the colour which Werner would call yellowish or brownish white—our whitest linens he would denominate grayish or bluish white. Most probably the Egyptians employed natron for the purpose of bleaching. "It would soon be observed, indeed, that the action of water, together with that of the sun and air, rendered cloth whiter than such as had been recently manufactured; and since the first step towards refinement is to add beauty to utility, as the state of Society improved, a desire to produce cloth of a pure and spotless white would naturally arise." Such simple modes of whitening cloth as would thus naturally be discovered, are alluded to by Job, (ix. 30,) who speaks of washing with Bor, rendered by Junius, *in loco*, *smegmate*, and supposed, by Goguet, (I. 132,) to be *saltwort;* and by Homer, the most ancient heathen author now extant, in the Sixth Odyssey, where Ulysses finds Nausicaa with her maidens employed in washing their garments, and bleaching them in the sun. We learn from Herodotus also, that the Babylonians wore tunics of *lawn* which descended to their feet, and that the art of bleaching these, and of staining them with different colours, was similar to that still practised in India. (See lib. I. N. 195, and Goguet III. p. 187.)

(TO BE CONTINUED.)

On the Nature and Properties of Timber, Extracted from "The Elementary principles of Carpentry, by THOMAS TREDGOLD."

(Continued from page 74.)

Laws of Seasoning.

The time that is required to season, or to dry a piece of timber, obviously depends upon its magnitude; for we have seen that in a small piece, it will become perfectly dry in a few days: therefore some rule in this respect is desirable. A complete solution of the problem cannot be effected without more accurate experiments had been made on pieces under various circumstances. But till something better shall be done, the following investigation may be useful.

The time required to dry a piece of timber, will depend on the quantity of surface exposed to the action of the air; and while the quantity of timber remains the same, the larger the surface, the sooner it will be dry.

Also, if the quantity of surface remain the same, the time of drying will be proportional to the quantity of matter; as the greater the quantity of matter under the same surface, the longer it will be in drying.

Let l be the length of a tree, which may be supposed to be a cylinder, and d its diameter, and $p=3{\cdot}1416$.

Then, by the principles of mensuration, the surface of the cylinder is equal to $pdl+\frac{1}{2}pd^2$; and its solid content is $\frac{1}{4}pd^2l$. But the time of drying will vary in the inverse ratio of the surface, and directly as the solid content: call this time T. Then $\frac{\frac{1}{4}pd^2l}{pdl+\frac{1}{2}pd^2}$: T, or $\frac{dl}{l+\frac{1}{2}d}$: T. And, if c be a constant quantity, to be found from experiments, we have $\frac{cdl}{l+\frac{1}{2}d}=T$, when the beam is cylindrical.

And in a rectangular beam $\frac{cbdl}{lb+ld+bd}=T$; where b is the breadth and d depth of the beam. When a table of reciprocals is at hand, the latter rule becomes much more convenient for calculation under the form $\frac{c}{\frac{1}{d}+\frac{1}{b}+\frac{1}{l}}=T$.

This investigation is made on the supposition that the evaporation is free and equal at every part of the surface; but this is not the case in seasoning, as the evaporation from the ends is greater than from the sides, and greater from the upper side, than from the under one; but it is perhaps sufficiently correct to be useful, at least till something better shall be done.

Equal drying would be much promoted by often turning the pieces, and by keeping them free from the ground or other damp bodies; and the more equal the drying is, the more nearly these rules will apply.

Timber is used in two states, that is, when it is *dry*, and when it is only *seasoned*. The term, seasoned, however, is not very accurately defined. Rondelet considers timber to be sufficiently seasoned for carpenters' work when it has lost about one-sixth of its weight. But according to my own observations, timber has undergone what is termed a proper seasoning, when it has lost about one-fifth of its weight; therefore, I shall call that timber *seasoned*, which has lost one-fifth of the weight it had at the time of felling.

It also appears from the experiments of Duhamel and Couch, that timber loses about one-third of its weight in becoming dry; and such a degree of dryness being sufficient for the joiner's purpose, I shall consider timber *dry*, when it has lost one-third of its weight.

Thus the terms *dry* and *seasoned* will have a more certain meaning; and when drying is carried to its greatest degree, the timber may be called *perfectly dry*, to distinguish it from that degree of dryness which renders it fit for joiners' work.

In order to compare the times required to season, and to dry timber, when the sizes of the pieces remain the same, it will be necessary to consider the progress of evaporation from the same quantity of surface.

Let the whole time be conceived to be divided into equal parts, then the quantity evaporated during any one of these parts of the time, will be inversely as the square of the time, between that part and the commencement. For as the time increases, the quantity of moisture decreases; and the force of evaporation being proportional to the excess of moisture, the quantity evaporated must decrease in the inverse ratio of the time; but if the evaporating force were constant, the quantity evaporated must be less and less at each successive space of time, from the decrease of moisture; therefore, as both the evaporating force, and the quantity to be evaporated, decrease with the time, the quantity evaporated during any space or part of the time, is inversely as the square of its distance from the commencement.

Now, according to this law, the whole quantity evaporated during any time, counting from the beginning of the process, will be inversely as the cube of that time: therefore, denoting the time necessary to season a piece of timber by unity, or 1, we may find the time required to dry the same piece. For $\frac{1}{5} : \frac{1}{3} :: \frac{1}{1^3} : \frac{1}{\text{cube of time of drying}} = \left(\frac{5}{3}\right)^3 = 4{\cdot}63$ nearly: that is, it requires 4·63 times as long to dry a piece of timber, as it does to season it, if the piece remain of the same size.

Hence it appears how slowly the process of drying goes on; and the preceding equations showing that it proceeds most rapidly in small pieces, the importance of reducing timber to its proper scantlings for use, is obvious. For, however dry a piece of timber may be, when it is cut to a smaller scantling it will still shrink and lose weight, being always less dry in the centre than at the surface; and the more rapidly the drying has been carried on, the greater will be the difference. Nevertheless, in the first stages of seasoning, it is best that it should proceed slowly; otherwise the external pores shrink so close as not to permit the free evaporation of the internal moisture, and the piece would split from unequal shrinking; and, lastly, it should be reduced nearly to the proper scantling some time before it be framed.

The long time which large pieces require to season, should render their use less frequent, without a proper time can be allowed. In the following table, I have given the times of drying and seasoning pieces of different sizes, calculated by the rules laid down in this article, which may be useful, as it shows at once the time necessary to bring different scantlings to the same degree of dryness.

Length in feet.	Breadth in inches.	Thickness in inches.	Time of seasoning in months.	Time of drying in months.
10	6	6	6½	29
10	8	8	8½	39
12	10	10	10	48
12	12	12	12	57
12	14	14	14	66
12	16	16	17	76
18	18	18	19	86
20	20	20	21	96

Of the decay of Timber.

Timber, when properly seasoned, is strong, tough, and elastic; but it does not long retain those properties, in any state or situation. Timber is generally employed in situations where it is continually dry, where it is constantly wet, where it is alternately wet and dry, or where it is exposed to heat and continued moisture. The effect of each of these states is the next object of attention.

Effect of continued Dryness.

Timber that is constantly dry, or affected only by the small quantity of moisture which it absorbs from the air in damp weather, has been known to last for seven or eight hundred years; but, even in this state, time produces a sensible alteration in its properties; for it is found to lose its elastic and coherent powers, gradually, and to become brittle. Hence it is unfit to sustain the action of variable loads, though in a state of rest, it may endure an immense length of time.

Effect of continued Wetness.

The wood of trees in its natural state, is a very compound substance; a certain portion of its constituents is soluble in water, another part may be extracted by alcohol, and the part remaining, after being treated with alcohol, is the pure woody fibre, or lignin, of chemists. After water has extracted all that is soluble by it, from timber, it is obvious that while the timber continues immersed in water it may remain unchanged for an indefinite period; but if it be taken out and dried, it is found to be brittle and effete; or, to use the workman's expression, "its nature is gone;" and, as Dr. Sloane has observed of oak that had been buried in a wet situation, "it dries, splits, becomes light, and soon impairs." But though oak timber taken from bogs is always found to be brittle and in a state of decay, fir, from the same bog is often, if not always, in a much sounder state.

Effect of alternate Dryness and Moisture.

When timber is exposed to the action of alternate dryness and moisture, it soon decays. It has been already noticed, that repeated steeping and drying removes a sensible portion of the wood at each operation; and it is evident, that at each drying a new portion of soluble matter is formed, which either did not before exist, or which is rendered soluble by a change in its principles. This conclusion is further established by Saussure, who found that wood, the most completely freed of its soluble principles, furnishes always by maceration in water, with the contact of air, infusions holding extractive matter dissolved. The effect of this kind of decay may be observed in weather-boarding, fencing, and in any situation where wood is constantly exposed to the vicissitudes of the weather. When the timber has been thoroughly seasoned, painting or any kind of coating that is capable of resisting moisture is the best means of preserving it from this kind of decay.

(TO BE CONTINUED.)

NATURAL HISTORY.

The following article is extracted from Dr. Godman's "AMERICAN NATURAL HISTORY;" the first volume of which, is about to be published, by Messrs. Carey & Lea, of this city. To do full justice to the author's general manner of treating his subject, we have inserted at full length, his account of the *Grizzly Bear:* from this it will be seen, that the work is not intended for the use of the technical naturalist, alone; but that its object is also to give that information respecting the animals of our country, which is most interesting and acceptable to the general reader. We shall hereafter make other selections from the same source, as in so doing, we feel assured that we shall communicate both pleasure and information.[*]

THE GRIZZLY BEAR.

Ursus Horribilis.—ORD.

Ursus Horribilis; SAY. Long's Exped. to the Rocky Mountains. vol. ii.
Ursus Cinereus; DESM. Mam. p. 164.
Ursus Ferox; The Grizzly, White, Variegated, and Brown Bear of LEWIS and CLARK.

This bear, justly considered as the most dreadful and dangerous of North American quadrupeds, is the despotic and sanguinary monarch of the wilds over which he ranges. Gigantic in size, and terrific in aspect, he unites to a ferociously blood-thirsty disposition, a surpassing strength of limb, which gives him undisputed supremacy over every other quadruped tenant of the wilderness, and causes man himself to tremble at his approach, though possessed of defensive weapons unknown to any but the human race. To the Indians, the very name of the grizzly bear is dreadful, and the killing of one is esteemed equal to a great victory:—the white hunters are almost always willing to

[*] The above work will consist of 3 vols. 8vo. of about 400 pages each. It will be illustrated with a considerable number of plates; the first volume contains fifteen; those which we have seen, are executed in a very good style, and the paper and typography, are excellent. The second volume, we understand, is nearly finished; and the materials for the third, are arranged. The price of the whole, will be ten dollars.

avoid an encounter with so powerful an adversary, and seldom, or never, wantonly provoke his anger.

This formidable bear, unhesitatingly pursues and attacks men or animals, when excited by hunger or passion, and slaughters indiscriminately, every creature whose speed or artifice is not sufficient to place him beyond his reach. The bison, whose size and imposing appearance, might seem to be a sufficient protection, does not always elude his grasp, as the grizzly bear is strong enough to overpower this animal, and drag its carcass to a convenient place to be deposited and devoured at leisure.

However singular it may appear, that an animal endowed with such a fondness for destruction and blood, can exist altogether on vegetable food, it is a fact that the grizzly bear, no less than all other species belonging to the same genus, is capable of subsisting exclusively on roots and fruits; this may be inferred from the peculiarities of their system of dentition. It is by no means surprising, that hunters and travellers should suppose the grizzly bear to be almost wholly carnivorous, seeing that he displays such an unappeasable ferocity of disposition, and so uniform an eagerness to destroy the life of any animal that falls within his power.

This bear, at present inhabits the country adjacent to the eastern side of the Rocky Mountains, where it frequents the plains, or resides in the copses of wood, which skirt along the margin of water courses. There is some reason to believe that the grizzly bear once inhabited the Atlantic regions of the United States, if we may be allowed to form any inference from traditions existing among the Delaware Indians, relative to the big naked bear which formerly existed on the banks of the Hudson. The venerable Heckewelder informs us, that Indian mothers used to frighten their children into quietness, by speaking to them of this animal.

Notwithstanding it was mentioned a long time since by La Hontan and other writers, it has been but recently established as a distinct species in the works of systematic zoologists. Say, was the first to give a full description of it, in the well known work we have quoted at the head of this article.

Two cubs of the grizzly bear were some time since kept alive in the menagerie of Peale's (now the Philadelphia) Museum. When first received they were quite small, but speedily gave indications of that ferocity for which this species is so remarkable. As they increased in size, they became exceedingly dangerous, seizing and tearing to pieces every animal they could lay hold of, and expressing extreme eagerness to get at those accidentally brought within sight of their cage, by grasping the iron bars with their paws and shaking them violently, to the great terror of spectators, who felt insecure while witnessing such displays of their strength. In one instance, an unfortunate monkey was walking over the top of their cage, when the end of the chain which hung from his waist, dropped through within reach of the bears; they immediately seized it, dragged the screaming animal through the narrow aperture, tore him limb from limb, and devoured his mangled carcass almost instantaneously. At another time a small monkey thrust his arm through an opening in the bear cage, to reach after some object ; one of them immediately seized him, and, with a sudden jerk, tore the whole arm and shoulder-blade from the body, and devoured it before any one could interfere. They were still cubs, and very little more than half grown, when their ferocity became so alarming, as to excite continual apprehension, lest they should escape, and they were killed in order to prevent such an event.

To the venerable founder of the Philadelphia Museum, Charles Willson Peale, to whom American students of natural history are under the most lasting obligations for his zeal and liberality, we are indebted for the following letter, written by the gallant and lamented Pike, relative to the two grizzly bears above mentioned:

Washington, Feb. 3*d*. 1808.

Sir,—I had the honour of receiving your note last evening, and in reply to the inquiries of Mr. Peale, can only give the following notes.

The bears were taken by an Indian, in the mountains which divide the large western branches of the Rio Del Norte, and some small rivers which discharge their waters into the east side of the gulf of California, near the dividing line between the provinces of Biscay and Senora. We happened at the time to be marching along the foot of those mountains, and fell in with the Indian who had them, when I conceived the idea of bringing them to the United States, for your Excellency, although then more than 1600 miles from our frontier post, (Natchitoces,) purchased them of the savage, and for three or four days made my men carry them in their laps, on horseback. As they would eat nothing but milk, they were in danger of starving. I then had a cage prepared for both, which was carried on a mule, lashed between two packs, but always ordered them to be let out the moment we halted, and not shut up again, until we were prepared to march. By this treatment they became extremely docile when at liberty, following my men (whom they learned to distinguish from the Spanish Dragoons, by their always feeding them and encamping with them,) like dogs, through our camps, the small villages, and forts, where we halted. When well supplied with sustenance, they would play like young puppies with each other, and the soldiers; but the instant they were shut up and placed on the mule, they became cross, as the jostling of the animal knocked them against each other, and they were sometimes left exposed to the scorching heat of a vertical sun, for a day, without food or a drop of water, in which case they would worry and tear each other, until nature was exhausted, and they could neither fight nor howl any longer. They will be one year old, on the first of next month, (March 1808,) and as I am informed, they frequently arrive at the weight of eight hundred pounds.

Whilst in the mountains, we sometimes discovered them at a distance, but in no instance were we ever able to come up with one, which we eagerly sought, and *that* being the most inclement season of the year, induces me to believe, they seldom or never attack a man unprovoked, but defend themselves courageously;* an instance of this kind occurred in New Mexico, whilst I sojourned in that province;—three of the natives, attacked a bear, with their lances, two of whom he killed, and wounded the third, before he fell the victim.

With sentiments of the
highest respect and esteem,
Your obedient servant,
Z. M. PIKE.

His Excellency, Thomas Jefferson,
President of the United States.

The grizzly bear, is remarkably tenacious of life, and on many occasions numerous rifle-balls have been fired into the body of an individual, without much apparent injury. Instances are related by the travellers who have explored the countries in the vicinity of the Rocky Mountains, of from ten to fourteen balls having been discharged into the body of one of these bears, before it expired. In confirmation of these statements we shall here introduce some sketches from narratives given in the journals of Lewis and Clark, and Long's Expedition to the Rocky Mountains.

One evening, the men in the hindmost of one of Lewis and Clark's canoes, perceived one of these bears lying in the open ground, about three hundred paces from the river, and six of them, who were all good hunters, went to attack him. Concealing themselves by a small eminence, they were able to approach within forty paces unperceived; four of the hunters now fired, and each lodged a ball in his body, two of which passed directly through the lungs. The bear sprang up and ran furiously with open mouth upon them; two of the hunters, who had reserved their fire, gave him two additional wounds, and one breaking his shoulder blade, somewhat retarded his motions. Before they could again load their guns, he came so close on them, that they were obliged to run towards the river, and before they had gained it, the bear had almost overtaken them. Two men jumped into the canoe; the other four separated, and concealing themselves among the willows, fired as fast as they could load their pieces. Several times the bear was struck, but each shot seemed only to direct his fury towards the hunter; at last he pursued them so closely that they threw aside their guns and pouches, and jumped from a perpendicular bank, twenty feet high, into the river. The bear sprang after them, and was very near the hindmost man, when one of the hunters on the shore, shot him through the head, and finally killed him. When they dragged him on shore, they found that eight balls had passed through his body, in different directions.

On another occasion the same enterprising travellers met with the largest bear of this species they had ever seen; when they fired he did not attempt to attack, but fled with a tremendous roar, and such was his tenacity of life, that although five balls had passed through the lungs, and five other wounds were inflicted, he swam more than half across the river, to a sand bar, and survived more than twenty minutes. This individual weighed five or six hundred pounds at least, and measured eight feet seven inches and a half from the nose to the extremity of the hind feet, five feet ten inches and a half around the breast, three feet eleven inches around the middle of the fore-leg, and his claws were four inches and three-eighths long.

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* It is very possible that the bears thus seen, may have been common black bears; the reader will find in the sequel abundant proofs that it is not difficult to come up with the grizzly bear, and that this animal does not often wait to be attacked.

In fact, the chance of killing the grizzly bear by a single shot, is very small, unless the ball penetrates the brain, or passes through the heart. This is very difficult to effect, since the form of the skull, and the strong muscles on the side of the head, protect the brain against every injury except a very truly aimed shot; and the thick coat of hair, the strong muscles and ribs, make it nearly as difficult to lodge a ball fairly in the heart.

Governor Clinton, in the notes to his discourse delivered before the Literary and Philosophical Society of New York, says, "that Dixon, an Indian trader, told a friend of his, that this animal had been seen *fourteen feet long;* that notwithstanding its ferocity, it had been occasionally domesticated, and that an Indian belonging to a tribe on the head waters of the Mississippi, had one in a reclaimed state, which he sportively directed to go into a canoe belonging to another tribe of Indians, then returning from a visit: the bear obeyed, and was struck by an Indian. Being considered as one of the family, this was deemed an insult, resented accordingly, and produced a war between these nations."

Mr. John Dougherty, a very experienced and respectable hunter, who accompanied Major Long's party during their expedition to the Rocky Mountains, several times very narrowly escaped from the grizzly bear. Once, while hunting with another person on one of the upper tributaries of the Missouri, he heard the report of his companion's rifle, and when he looked round, beheld him at a short distance endeavouring to escape from one of these bears, which he had wounded as it was coming towards him. Dougherty, forgetful of every thing but the preservation of his friend, hastened to call off the attention of the bear, and arrived in rifle-shot distance, just in time to effect his generous purpose. He discharged his ball at the animal, and was obliged in his turn to fly; his friend relieved from immediate danger, prepared for another attack, by charging his rifle, with which he again wounded the bear, and saved Mr. D. from further peril. Neither received any injury from this encounter, in which the bear was at length killed.

On one occasion several hunters were chased by a grizzly bear, who rapidly gained upon them. A boy of the party, who could not run so fast as his companions, perceiving the bear very near him, fell with his face toward the ground. The bear reared up on his hind-feet, stood for a moment, and then bounded over him in pursuit of the more distant fugitives.

Mr. Dougherty, the hunter before mentioned, relates the following instance of the great muscular strength of the grizzly bear. Having killed a bison, and left the carcass for the purpose of procuring assistance to skin and cut it up, he was very much surprised on his return to find that it had been dragged off, whole, to a considerable distance, by a grizzly bear, and was then placed in a pit, which the animal had dug with his claws for its reception.

This bear strikes a very violent blow with its fore-paws, and the claws inflict dreadful wounds. One of the cubs before mentioned as belonging to the Philadelphia Museum, struck the other a blow over part of its back and shoulder, which produced a large wound like a sabre cut. It is stated in Long's Expedition, that a hunter received a blow from the fore-paw of a grizzly bear, which destroyed his eye and crushed his cheek bone.

The grizzly bear is unable to climb trees like other bears; he is much more intimidated by the voice, than the aspect of man, and on some occasions, when advancing to attack an individual, he has turned and retired merely in consequence of the screams extorted by fear. The degree of ferocity exhibited by the grizzly bear, appears to be considerably influenced by the plenty or scarcity of food in the region it inhabits.

Anterior to the time of Lewis and Clark's expedition, nothing very satisfactory was known relative to this bear, and it was not until the publication of the journal of Long's Expedition to the Rocky Mountains, that a correct, scientific description, was given by that distinguished naturalist, Say.

It may be with certainty distinguished from all the known species of this genus, by its elongated claws, and the rectilinear or slightly arched figure of its facial profile. Its general appearance may be compared with the Alpine bear of Europe, (U. Arctos) especially with the Norwegian variety. The Alpine bear has not the elongated claws, and the facial space is deeply indented between the eyes.—This bear is also a climber; the grizzly bear is not.

On the front of the grizzly bear the hair is short, and between and anterior to the eyes, it is very much so. On the rest of the body it is long and very thickly set, being blacker and coarser on the legs, feet, shoulders, throat, behind the thighs, and beneath the belly; on the snout it is paler. The ears are short and rounded, the forehead somewhat convex or arcuated, and the line of the profile continues on the snout, without any indentation between the eyes.

The eyes are quite small, and have no remarkable supplemental lid. The iris is of a light reddish brown, or burnt Sienna colour. The muffle of the nostrils is black, and the sinus very distinct and profound. The lips are capable of being extended anteriorly, especially the upper one, which has on it a few more rigid hairs or bristles than the lower lip. The tail, which is very short, is concealed by the hair. The length of the hair gradually diminishes on the legs, but is still ample in quantity on the upper part of the foot.

The claws on the fore-feet are slender and elongated, and the fingers have five sub-oval naked tubercles, separated from the palm, each other, and the base of the claws, by dense hair. The anterior half of the palm is naked, and is of an oval figure transversely,—the base of the palm has a rounded naked tubercle encircled by hair.

The soles of the (hind) feet are naked, and the nails are more curved and not so long as those on the fore-paws. The nails are not in the least diminished at tip, but they grow sharper at that part only by lessening from beneath.*

The colour of the grizzly bear varies very considerably, according to age and its particular state of pelage. Hence they have been described as brown, white, and variegated, by Lewis and Clark, although evidently of the same species, judging by all the other characters. The colour of the young animal approaches more nearly to the brown bear of Europe than any other; in advanced life the colour is that peculiar mixture of white, brown, and black, which has procured for this bear the appropriate designation of "Grizzly."

The following are the dimensions of the specimens preserved in the Philadelphia Museum, as given by Say.

Length from the tip of the nose to the origin of the tail,	5 ft.	2 in.
The tail exclusive of the hair at tip,		1¾
From the anterior base of the ear to the tip of the nose,		6
Orbit of the eye,		¾
Between the eyes,		4⅖
Ears from their superior base,		3
Longest claw of the fore-foot,		4⅕
Shortest,		2¾
Longest claw of the hind-foot,		3
Shortest,		1¾
Hair at the tip of tail,		4½
Length of the hair on the top of the head,		1¾ to 2
Beneath the ears,		2½ to 3½
On the neck above,		3
On the shoulders above,		4½
On the throat,		4
On the belly and behind the fore-legs the longest hairs are		6

These measurements are taken from two individuals which were by no means full grown, as may be perceived by comparing them with the measurements heretofore cited from Lewis and Clark.—They will serve, however, to give a fairer idea of the proportions of this animal than any which have been previously given, as they are so much more detailed and very carefully made.

On softening cast Iron.

The subjoined extract from the reports of Mr. Strickland (just published) will probably bring to mind some statements made in our first number, on the subject of the art of rendering cast-iron malleable, as practised in England. The *Cumberland red ore*, is, it appears, found in various parts of the Island of Great Britain, and there are, undoubtedly, several varieties of iron ore in the United States, which will answer the same purpose. The Cumberland ore is probably an *argillaceous oxide of iron*. The *Hematetic iron ore*, which consists of oxide of iron, silex, and alumine, has been successfully used in England, but as it is a very hard substance, the difficulty of reducing it to powder, in sufficient quantities, is a bar to its employment in the large way.

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* Ursi Horribilis testes saccis duobus distinctis, etiam ad quatuor pollicum segregatis, pendunt.

The *Ochery red oxide of iron*, (red-ochre) is known to abound in many of the states, and is, probably, similar to that of Cumberland. The *Bog-ore*, so abundant in New Jersey, and in many other places, would be likely to answer the purpose, when not contaminated by phosphate of iron. Those who are interested in experimenting upon the subject, would do well to make the essay with the several varieties of ore which they can obtain, as the comparative goodness of each might then be ascertained, in a single operation. [*Editor.*

"There has been a method lately discovered, to make cast metal, soft and malleable; and there are already many large manufactories put up, for this very important process. I have visited one of them in London, and witnessed the operation. The method consists, in placing the cast metal in a case or pot, along with, and surrounded by, a soft, red ore, found in Cumberland, and other parts of England. The cases are then put into a common oven, built with fire-bricks, and without a chimney, where they are heated with coal or coke, placed upon a fire-grate. The doors of the oven are closed, and but a slight draft of air permitted under the grate; and thus a regular heat is kept up, for the space of seven days, or two weeks, depending on the thickness and weight of the castings. The cases are then taken out, and suffered to cool, and the hardest cast metal is, by the operation, rendered so soft and malleable, that it may be welded together, or when in a cold state, bent into almost any shape, by a hammer or vice. In this manner are all articles, such as harness buckles, bridle bits, horse shoes, and even nails, made tough and malleable. Cast horse shoes, submitted to this process, have, after being worn out by the action of the horses' feet, been converted into penknives, and other articles of cutlery, of a superior quality. I have procured a specimen of the red ore used in this valuable process, together with a few articles of the hardest cast iron, which have been softened, and rendered perfectly malleable. Those castings, however, which are made from pig iron containing the smallest portion of carbon, are the best adapted for conversion into malleable iron: the only effect produced by the introduction of the red ore, along with the metal, is to deprive it of its carbon."

Letter from Robert Hare, M. D. *Professor of Chemistry, in the University of Pennsylvania, to Dr. Thomas P. Jones, Editor of the Franklin Journal; on the means of preventing, or extinguishing fires in Steam Boats.*

Dear Sir,

Since I wrote to you on the causes of the explosions of Steam-boat boilers, I have seen the account of the loss by fire, of the Steam-brig New York.

The escape of the passengers from drowning or burning, appears to have been due to their number being fortunately small, and the accidental proximity of the boat to the land. This is an appalling contingency; yet I feel confident, that it is possible to lessen, if not to put an end to all danger, from this source.

In the first place, the flues and the furnace may be so situated, that the wood work can in no case be set on fire by them. In the second place, by means of a capacious pump to be worked by the engine, and other pumps in different parts of the vessel, to be worked by the crew and passengers, a torrent of water might in a few moments, by the aid of hoses and pipes, be directed upon the fire.

It would be highly important to have also a number of leather fire buckets hung up in an appropriate place, and kept in order; also, buckets with ropes attached to them, to draw up water by hand. The crew should be trained to use the pumps, the hoses, and the buckets for drawing water. If a due degree of discipline were established among them, the efforts of the passengers would soon take the same direction; so that their numbers would tend to diminish the danger, instead of rendering it greater.

There should be at least four good hand pumps, two forward and two aft, besides the pump to be wrought by the engine. From this pump, which could always be used when the fire should not be so situated as to incapacitate the machinery, two iron pipes should proceed, one to the forward, the other to the after part of the boat; to these pipes there should be large cocks with hose permanently attached, of length sufficient to command the greater part of the boat. Each hose should always be kept upon a reel; so that on the captain's giving an order to work the fire pump, either might be immediately ready for use, and the water spouting, from the terminating pipe, be under the direction of one of the crew, who should be trained for that purpose, to know his post, and perform his duty with skill and agility.

I am, &c.

Robert Hare.

New Steam Engine.

Norfolk, Virginia, August 17, 1826.

It affords us much pleasure, to notice briefly, an ingenious invention by a townsman of ours, Mr. Matthew Cluff, which, dispensing with all complicated apparatus, and even that of ordinary pistons and valves, at once applies this valuable agent to the purpose of impelling a wheel of any diameter with an equable motion, capable of being applied to any species of machinery. We yesterday saw the model (upon a small scale) in operation, and were struck alike with the simplicity of the machine, and the ease and regularity of its movement. A very correct idea of it may be formed by supposing one end of a plain tube, of any dimensions required, to be inserted into a boiler, round which a fire is made, and the other end entering near the bottom, a reservoir of water, heated by the steam continually passing into it through the tube. In the reservoir, a wheel with buckets, similar to that of an overshot mill, revolves on a common axis, deriving its motion, (which is rapid and of a power susceptible of any augmentation desired) from the steam, which in its ascent from the bottom of the reservoir where the tube enters, continually fills the buckets and gives the wheel the necessary impetus.

We understand that Mr. Cluff intends to apply for a patent for his invention, and will probably test its value, by erecting a machine without delay.

Remarks by the Editor.—If we understand the above description, we apprehend that the proposed *improvement* may serve to swell the list of patents, but not to facilitate the application of steam, as a motive power. The proposed wheel, is, it appears, to wade in water, which its ascending and descending buckets must displace; this will consume a considerable portion of power;—and what is the power which is to overcome this resistance, and to propel the machinery? We see none, excepting the difference in the density of the water, and of the steam contained in the ascending buckets; and this will, in practice, be much less than that which would be produced by blowing air through the tube, and filling the buckets with this, instead of with steam.

The correctness of this remark will appear, when it is recollected that if the water in the trough be kept at a boiling heat, steam will ascend from it, on both sides of the wheel; and, if not at a boiling heat, the steam discharged through the pipe, will be in great part condensed, and the fuel be consequently used in vain.

Were oil substituted for water, in filling the trough, some of these objections would be removed, and we think that the *model* would be improved, but that the improvement would still end there.

The greater number of proposed improvements in the steam engine, equally manifest the possession of ingenuity, and the deficiency of knowledge and experience, in their projectors. Much time and money would be saved, and much mortification prevented, would inventors more generally avail themselves of the facilities afforded by the *Franklin Institute*, of acquiring practical information upon all subjects connected with mechanics.

The committee of inventions, is appointed for the express purpose of examining all machines and improvements, for the sole benefit of inventors; the utmost secrecy being observed, when necessary, and the first talents being employed in the respective departments, in order that correct information may be given, and that, without expense to the applicant.

Self acting Piano Forte.

The Dublin Journal gives a long notice of the mechanism of an ingenious instrument of this kind, stating that it performs, with extraordinary effect, some of the most classical and difficult music, and that great difficulties have been surmounted by the inventors. It combines the utmost rapidity and brilliancy with distinctness and neatness, and they venture to affirm, that there are few players of the piano-forte that can equal it, in these qualities. Its harmony is necessarily more full than can be produced by eight fingers, the elements of chords having no other limit than the extent of its scale. The instrument not only plays the usual piano-forte part of a piece, but takes in also, the subject of some parts of the score; its *crescendo* and *diminuendo* are graduated with more precision than can be effected by means not mechanical, the time cannot be otherwise than perfectly equable throughout, yet where pathos is to be expressed, the time can be retarded or accelerated, in any degree. In short, this admirable instrument manifests all the capabilities of a living performer, and superadds qualities derivable only from mechanical agency.—The mechanism is simple; it consists of a cylinder which turns on its axis, and is acted on by a coiled spring, and regulated by a fly wheel. On the surface of the cylinder, a proper arrangement of brass pins is formed, each of which, in passing under a rank of levers, elevates one end of the required lever, and depresses the other. The pressed end, pulls down with it a slender rod, which is connected by a slide with the tail of a bent lever, on the further end of which is the hammer which strikes the string.—The slides can be shifted further from, or nearer to, the axis, on which the hammer lever turns, and thus the stroke of the hammer is made feeble, or strong, to any required degree. When wound up, the instrument will continue to play for a considerable time; and it is provided with a set of keys like the ordinary piano-forte, so that a person may accompany the instrument, or play a duet with it, the effect of which is said to be beautiful.

Remarks by the Editor.—That *barrel piano fortes*, may as well be made, as barrel organs, every mechanisian well knows, and that they will hold the same comparative rank, no musician need be informed. The organist, however, will never wish for a barrel organ, nor the piano forte player, employ an automaton instrument, unless they can be made to express all the taste, feeling and variety of which keyed instruments are capable, however mechanically correct they may be in their execution. In fact, such instruments, although they may serve to show the consummate skill of the workman, ought never to be admitted as improvements, so far as the science of music is concerned, and will never be highly valued, excepting by those who cannot play.

Sugar from Beets.

The July number of the London Journal of Science and the Arts, contains an interesting article, on the manufacture of Sugar, from Beet Root. We extract, from that article, the following information.

"Mr. Dubrunfaut, (a French writer) states, that there are actually in France at present no less than 100 manufacturers of beet-root sugar, which may, he states, furnish altogether from four to five million pounds of raw sugar, (2000 to 2500 tons) which is not a twentieth part of the consumption of France. The largest manufacturers generally produce 40 to 50 tons per annum, some few more; but the average quantity, from his statement, appears to be only 20 to 25 tons per annum. He says the manufacturers are increasing in number; but if these data be correct, we are led to wonder why the manufacture has not been extended much more considerably in France, for in that country the duty on imported raw sugar is about 15s. 5d. per cent., or rather more than 1½d. per pound, from which duty the makers of beet-root sugar are exempted; if they however, can produce their sugar at 3¼d. or 3½d. per lb., the manufacture must be a very profitable one, as the selling prices are actually 4½d. to 5d. per lb. duty paid, and the article cannot be produced in the West Indies, and sold duty paid in France, for less. Dubrunfaut acknowledges this, and states it as a fact, which ought to encourage the extension of the beet-root manufacture. As, however, it has now been carried on in France to a greater or less extent, for above ten years, it seems reasonable to conclude that it does not yield so great a profit as to encourage its great extension, in preference to other commodities, and, consequently, that it cannot be produced (according to the mode of producing it now adopted) so cheap as is represented by Dubrunfaut.

"In England the beet-sugar I believe, could be produced nearly as cheap as in France, weight for weight, and as the cost of fuel for the manufacture would be much less, (in France it amounts to about ⅙ part of the whole cost of the manufacture, including the price of the roots,) it might be supposed that it would be a profitable manufacture; the more so, as the sugar imported from the British West India colonies, pays a duty of very near 3d. per lb. But it is probable the root would be much more expensive in working, from its greater bulk, and less productive of sugar, from the juice not being so well matured by the sun, as it is in France. I believe the experiment has not been tried.

"In Germany and other countries of Europe, the duties on imported sugar, are so small, that it is probable this manufacture will not be attempted."

Vermont Gold.

A beautiful piece of native gold, weighing nearly ten ounces, was lately found in the town of Newfane, Vermont. It was picked up by a boy near a small brook, and was studded with crystals of quartz. We have been favoured by Mr. French of this city, with the perusal of a letter from a friend in that place, from which we extract the following particulars. "A mass of native gold, weighing nearly ten ounces, has been found in this village, upon the farm of Samuel Ingram. In its general appearance, it strikingly resembles the North

Carolina gold—specific gravity 16.5—considered worth 89 cents per pennyweight. It was found on the bank of a stream, which empties into the branch opposite this village." We have seen another letter, which says that the inhabitants of the village "are about turning out on a grand search for more of the precious metal, and every witch-hazle thereabouts, has been subsidized for a mineral rod!" We understand that a gentleman in that neighbourhood is preparing a full and scientific description of the gold, and the region in which it was found.

FOR THE FRANKLIN JOURNAL.

On the importance of Drawing, to Mechanics.

Feeling the importance of a public institution, where the teaching of drawing constitutes a prominent feature, it appears to be proper to make such remarks as may tend to advance the views of the Franklin Institute in establishing a school, from which its members, and the public are to derive so many advantages.

As drawing is at present taught in the school connected with this Institution, it may be distinctly divided into two branches: the first, which is architectural, comprises all the departments of mechanical drawing; and the second, embraces the study of drawing, as connected with the fine arts. It is proper to observe, that mechanical drawing is immediately connected with various occupations; and is necessary to Cabinet-makers, Carpenters, Stone-cutters, and mechanists of all descriptions; and they, by their being instructed in a course of geometrical drawing, may acquire a knowledge of designing, relative to their professions, upon sound principles.

That branch of drawing which is termed miscellaneous, includes the useful and ornamental; it is like the aforementioned study, connected with various pursuits: a knowledge of this art, is indispensable in many departments of manufacture, such as printers of cottons, all woolen manufactures, that are ornamented, ornamental paper makers, chair-painters, chasers in various metals, Stucco workers, and painters of ornaments of all descriptions: it is essentially necessary to the student who wishes to make Painting his profession.

As the advantages and utility of the school are acknowledged by the public, it will be well to state what is necessary from the pupils, to render this academy more eminently beneficial. It must be observed, that very few persons feel aware of the difficulty of learning to draw well, and the time it requires to effect this object. It is therefore seriously recommended, that students should consider the importance of following up the plan they adopt, not commencing at the school, and relinquishing it after the first or second quarter; for it is by this determination only, that they may expect to obtain by industrious application, so much information and practice on the subject, as will render the pursuit interesting and beneficial to themselves, do honour to the Institution that fosters them, and credit to their teachers.

B.

Drawing School of the Franklin Institute.

The Drawing School for the evening, will commence at the Hall of the Franklin Institute, on the 2nd of October, 1826, and will continue until the 2nd of April, 1827; thereby forming two quarters of evening tuition. From that time, the school will be held in the morning, and so on throughout the rest of the year.

List of Patents granted in England for New Inventions, since May 23, 1826.

To Daniel Dunn, for an improvement or improvements upon the Screw-press, used in pressing of Paper, Books, Tobacco, or Bale Goods; and in the expressing of Oil, Extracts, or Tinctures; and for various other purposes, in which great pressure is required. Dated May 23, 1826.—To be specified in six months.

To Thomas Hughes, for improvements in the method of restoring foul or smutty Wheat, and rendering the same fit for use. Dated May 23, 1826.—In six months.

To Thomas Molineaux, for an improvement in machinery for spinning and twisting Silk and Wool; and for roving, spinning, and twisting Flax, Hemp, Cotton, and other fibrous substances. Dated May 23, 1826.—In six months.

To Thomas Parrant Birt, for certain improvements on, or additions to Wheel Carriages. Dated May 23, 1826.—In two months.

To John Parker, for certain improvements on, or additions to Park or other Gates. Dated May 23, 1826.—In six months.

To Dominique Pierre Deurbroucq, who, in consequence of a communication made to him, by a person residing abroad, is in possession of an apparatus adapted to cool Wort or Must, previous to its being set to undergo the process of Fermentation; and also for the purpose of condensing the Steam arising from Stills, during the process of distillation. Dated May 23, 1826.—In six months.

To William Henry Gibbs and Abraham Dixon, for a new kind of Piece. Goods, formed by a combination of threads, of two or more colours; the manner of combining and displaying such colours, in such piece goods, constituting the novelty thereof. Dated May 23, 1826.—In two months.

To Joseph Smith, for an improvement on the Stocking-Frame; and an improved method of making stockings, and other goods usually made on the Stocking-Frame. Dated May 23, 1826.—In six months.

To John Loach, for a self-acting Sash-Fastener, which fastening is also applicable to other purposes. Dated May 23, 1826.—In six months.

To Richard Slagg, for an improvement in the manufacture of Springs, chiefly applicable to Carriages. Dated May 23, 1826.—In six months.

To Louis Joseph Marie, Marquis de Cambis, who, in consequence of a communication made to him by a certain foreigner, residing abroad, is in possession of certain improvements in the construction of Rotatory Steam-Engines, and the apparatus connected therewith. Dated May 23, 1826.—In six months.

To James Barlow Fernandez, for certain improvements in the construction of Blinds or Shades, for Windows, or other purposes. Dated May 26, 1826.—In six months.

To Robert Mickleham, for certain improvements in Engines moved by the pressure, elasticity, or expansion of Steam, Gas, or Air; by which a great saving in fuel will be effected. Dated June 6, 1826.—In two months.

To Henry Richard Fanshaw, for an improved Winding Machine. Dated June 13, 1826.—In six months.

To John Ham, for an improved process for promoting the action of the Acetic Acid on Metallic Bodies. Dated June 13, 1826.—In six months.

To Thomas John Knowlys, who, in consequence of a communication made to him by a certain foreigner, residing abroad, is in possession of a new manufacture of Ornamental Metal or Metals. Dated June 13, 1826.—In six months.

NOTICES.

The Franklin Journal contains many articles of great interest to the mechanic, the agriculturist, the artist, and others. The Editor has seen with pleasure, a republication of many of them, in the daily and weekly journals; and as he is sincerely desirous of diffusing useful information, he will cheerfully loan any of his Wood-cuts to those editors who wish for them; exacting only a careful return of them, and due credit to the journal. The Jackson Democrat, printed at Reading, has used our pages freely, and advertised the work liberally; for which we acknowledge ourselves truly obliged.

Two of the plates referred to in Major Long's paper, are reserved for the next number.

A few additional copies of this paper have been printed, and may be had at Mr. Dobson's, stitched up in the pamphlet form, with four copper plates, at 25 cents each.

Owing to the absence of the Editor, during the time of printing a considerable portion of the last number, some trifling mistakes were made; and in the paper on *Mechanical Jurisprudence*, there were two; one of which materially interferes with the sense, and renders necessary the following

ERRATA.

P. 90, 3d line from bottom, for *Literce Patentes*, read *Literæ Patentes*.

P. 91, line 7th, the paragraph should end with the word 'Whatsoever;' and the next paragraph should read thus. Whenever this allowance interferes with the general freedom of trade, or occupation, by restraining the right of buying, selling, or using, any thing; the power to grant it, has been considered an odious prerogative.

THE

FRANKLIN JOURNAL,

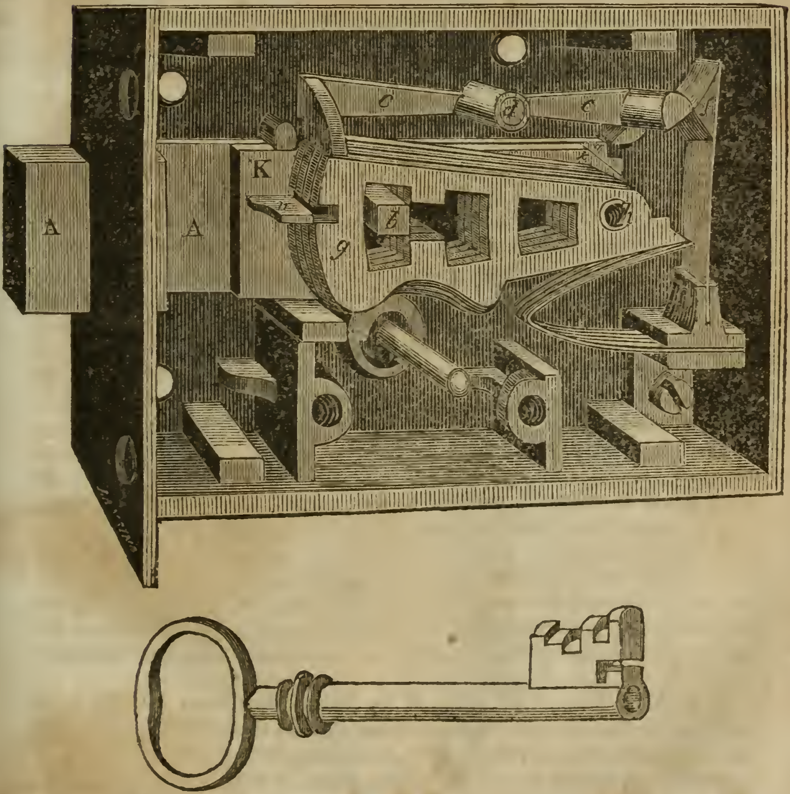
AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS,
AND GENERAL SCIENCE.

OCTOBER, 1826.

CHUBB'S PATENT DETECTOR LOCK.



Description of the Detector Lock.

The preceding drawing will give our readers a full insight into the peculiarities of Chubb's celebrated Detector Lock. A A *a*, the bolt; *b*, the square pin of the bolt; *c c*, the detector moving on the centre *d*; *f*, the detector spring; *g*, four tumblers moving separately on the centre *h*, shown lifted by the key to the exact position, for the square pin *b* of the bolt to pass in unlocking. Should one or more of the tumblers be lifted by a pick, or false key, in the least degree beyond their present position, the detector *c c*, being thus over-lifted, will, by the angle of the spring *f* pressing on the opposite side of the angle of the detector, force its hook into the notch of *a* the bolt, and be firmly held so, until disengaged by the regulating slide K *k*; in which case, by the introduction of the key, the tumblers are lifted to the *regulating combination*, and admit the stud *n*, affixed to the regulating slide, to enter the several grooves in the ends of them; the beveled end *k* of this slide, by the same movement, pressing against the hook of the detector, disengages it from the notch *a* of the bolt.

The merits of this lock, as stated by the ingenious inventor, are, that it possesses, in a much higher degree than any other, the four principal requisites of a good lock; viz. security, simplicity, strength, and durability. Its security is increased beyond calculation, by an improvement which not only renders it impossible to be picked or opened by *any* false instruments, but also *detects the first attempt* to open it; thereby preventing those *repeated efforts*, to which even the best locks hitherto invented are exposed. The instant that one or more of the tumblers are lifted beyond the place where the bolt is at liberty to pass, it overlifts the detector, which then hooks the tail of the bolt, prevents it from passing, and thus gives incalculable additional security (as well as immediate notice, the first time the true key is put into it to open it, that an attempt has been made to pick it,) and renders all farther attempts useless, it being *impossible* to discover the *first* combination, in order to disengage the detector, or the *second*, in order to remove the bolt. Nothing, in short, but the true key can either release the Detector from its grasp on the bolt, or open the Lock.

The simplicity of its construction, and strength of its parts, are such, that no false key or other instrument, introduced into it, for the purpose of opening it, can (without very great violence) injure it. The keys are *small* and portable, particularly those for iron doors.

With respect to its durability, it is not liable to be injured by constant use in any length of time; this has been ascertained by an iron-rim lock having been attached to a steam-engine in the dock yard, Portsmouth, (to try the effect of friction,) by which it was locked and unlocked upwards of four hundred and sixty thousand times, without receiving the least injury.

Mr. Chubb having, by order of the honourable Navy Board, lately supplied a considerable number of his Patent Detector Locks for the use of the Portsmouth dock-yard, and being informed that there was a convict on board one of the prison ships at this port, who was notorious for picking locks (being by profession a lock maker, and who has, till recently, for several years been chiefly employed in picking and repairing locks in London,) Mr. C. requested the favour of Commissioner the Honourable Sir George Grey to send for this man, that he might exercise his skill in attempting to pick his lock; and the Commissioner having been pleased to acquiesce in this request, the man was sent for accordingly, and one of Chubb's Patent Locks was submitted to his inspection, at the Storekeeper's office, in the presence of several of the principal officers; when, after a careful examination, he said, "he thought he could pick or open it with false instruments." He was therefore furnished with files, and all the tools he stated to be necessary to prepare the instruments for his purpose; and was directed to give notice to the storekeeper when he should be ready to make the trial, for the promotion of which, a reward of five pounds was promised him if he succeeded. In about three weeks after this time, he sent to say that he was ready; and a time being fixed for the purpose, he commenced his operations in endeavouring to pick one of the locks, in the presence of the principal officers of the dock-yard; but he could not succeed. He then stated, "that his failure was in consequence of his instruments not exactly fitting the lock." To remove this impediment, the Patentee offered to supply him with some blank keys, which should fit two of the locks, in order to his making another trial; these were furnished accordingly, together with a lock exactly the same in principle and in kind as those he had been trying, so that he might examine its construction, and make himself master of its principle. Shortly after, he made another attempt to pick two of the locks, in the presence of the honourable Sir George Grey, and the principal officers of the dock-yard; his success in this attempt was not better than the first; but he overlifted the detector of each lock. Sir George Grey then asked him what he would do in this case, supposing he had been making an attempt on such a lock, with an intent to commit a robbery? He said, "I would go no more to the lock; they would set a watch, and catch me." He still thought, however, that by a further alteration of the instruments, he could yet succeed; more time was therefore given, and every facility afforded him. Some time afterwards he again repeated his efforts in the presence of the same gentlemen; but having, in his previous experiments, overlifted the detectors, he could not by any means disengage them; this was done for him several times with the keys belonging to the locks; but, as often as they were regulated, on every successive trial he overlifted them again; till at last he gave it up, saying, "that he had used his utmost ability in his repeated attempts, and could not succeed: that these locks were the most secure he had ever met with, and that he did not think it possible for any man to pick or open them with any false instruments whatever." [*London Mechanic's Magazine.*

On the Mineral History of Gold, and the separation of it from Earthy and Stony Bodies, by Water, Mercury, &c. By the late William Lewis, M. D.

(Continued from page 171.)

On the separation of Gold from Earthy and Stony Bodies, by Water.

Gold, intermixed with earthy bodies, in small particles or dust, is separated by washing with water, which carries off the lighter earth, and leaves the more ponderous metal behind: the great gravity of gold, renders it better adapted to this way of separation, than any of the other metals. There are sundry variations in the manner of conducting the process, according to the quantity of the matter, the nature of the earthy body, and the conveniency of the place; many of which are minutely described by Agricola, in his treatise *de re metallica.* It will be sufficient here, to give a general idea of the manner of procedure, in an operation merely mechanical, and whose success depends chiefly on manual dexterity, acquired by practice.

Where the quantity of matter is small, it is laid, by a little at a time, in a round, shallow dish, called a buddle; or in an oblong vessel, like a boat; which being gently shaken backwards and forwards in a tub of water, the lighter part of the earth is taken up, and washed off, leaving with the gold such sand, or small stones, as the mixture contained. By dexterously repeating the agitation, that the whole may acquire, as it were, a kind of fluidity, the metalline particles sink to the bottom, and the sand or stones are thrown up to the top, and may be removed by the hand.

At several of the gold mines of the Spanish West Indies, the gold is completely separated by this simple operation. According to Don Ulloa's account, in his voyage to those parts, the earth, as it comes from the mine, is thrown into a reservoir, a stream of water conducted upon it, the whole stirred together, and the muddy water let off into another and another reservoir; and what it deposits in the others, is taken up in trays or buckets with two handles, and agitated in fresh waters, with a uniform circular motion, till the gold is collected at the bottom.

M. de Reaumur, in the French memoirs for the year 1718, gives a particular description of the method of washing the gold sands of the Rhine, and some other rivers. A board, five feet long, a foot and a half wide, with a ledge at each side, and at one end, is laid aslope, with this last end on the ground, and the other raised a foot and a half: across the board are nailed three pieces of rough cloth, each about a foot wide, and at distances of a foot; and at the upper end is placed a kind of basket, made of rods. The sand is shovelled into the basket; water thrown on it washes the sand through, the stones remaining: the earth, and lighter parts of the sand, are carried down to the bottom of the board, while the particles of gold, and the heavy black and red sands, already mentioned, are detained by the rough cloths; which, when they appear covered, so as not to be able to detain more, are taken off, and washed in a tub of water, then nailed on again, and the process continued, till a proper quantity of this richer sand is obtained. In some places, instead of the cloths, skins, with the hair or wool on, are used; and in others, notches are made across the board. The richer sand, thus detained, is put into a vessel somewhat like a boat, which is gently shaken in water, in the same manner as the sieve in winnowing corn, till the lighter grains rise to the top: these being carefully poured off with the water, the agitation is repeated, so long as any grains, of a different colour from the rest, are found to rise. No further separation is to be expected by this method; and the gold, of which some particles begin now to be distinguishable by the eye, is extracted from the remaining matter by mercury, as will be described in the following article.

Gold, bedded in stones, may frequently be separated from great part of the stony matter, on the same principle; the stone being previously reduced to powder. In the large way, it is beaten in mills, under water, by large wooden stampers, armed at the bottom with iron; an iron grating being commonly fixed at one side of the trough, or pit, through which the finer parts are continually washed off by the water. When a little quantity is to be powdered in a mortar, it should likewise be done *by blows of the pestle, not by grinding: a blow only flattens the metalline particles, while triture wears and divides them, in part, to such tenuity, as not freely to subside in water.* Stones of the hard flinty kind are previously made red-hot, and quenched in water; by which means, they are rendered more easily pulverable; and, at the same time, many of the small particles of gold, melting in the fire, unite, and form large masses.

On the separation of Gold from Earths and Stones, by Mercury.

Where the minuteness of the particles of gold, and the weight of the matter with which they are intermixed, render them inseparable by water, quicksilver is called in aid for imbibing and detaining the gold. The gold sands, freed by water, as in the foregoing article, from as much of the lighter matter as can be washed off by water, without endangering a great loss of the gold, are dried, and a small proportion, less than a hundredth part of their weight, of mercury poured on them: the whole is well kneaded up together, that the mercury may penetrate as much as possible into all the interstices between the grains; it imbibes the atoms of gold it meets with, and the sand is afterwards washed off by water.

In the Spanish West Indies, at those mines where the gold is imbedded in stones, and requires quicksilver for its separation, the stony matter is reduced to as fine powder as possible, that every atom of the gold may be laid open to the mercury. The powder is soaked, for some time, in a solution of common salt; the mercury squeezed out through a linen cloth, so as to fall like dew all over the surface of the cloth: and the mixture being well stirred and kneaded, a gentle heat is applied, by which the activity of the mercury is so far increased, that the incorporation of the gold with it, which, in the cold, requires about thirty days, is said by J. Hernandez, in an essay on these mines, to be effected by this method in five or six days.

Alonso Barba, in the third book of his Art of Metals, describes another method, which, he says, he has practised with great advantage: he puts the powder, with a suitable quantity of mercury and water, into a deep copper vessel, fixed in a furnace, and applies a fire sufficient to keep the water boiling; a small wooden mill assists the ebullition of the water, in giving motion to the earthy powder, which, continually rising and falling down again, is brought into frequent contact with the mercury at the bottom, so as to give out its gold to the mercury in as many hours as the common process, without heat, requires days.

When the gold is judged to be united with the mercury, the earthy powder is washed off by water, so as to leave the amalgam clean. Where the mercury has been kneaded up with the powder, a considerable part of it is always divided into such minute globules, as to be washed away along with the earth; an inconvenience, which, in the other method, does not happen, or in a far less degree.

On the separation of Gold from the sweepings of Goldsmiths' and Jewellers' Shops.

The gold dust, or filings, dispersed through the sweepings of the goldsmiths' shops, are recovered by amalgamation with mercury. Two broad iron bars, rounded at their ends, placed cross-wise, and fixed on an upright axis, are made to turn, by a handle at the top of the axis, on an iron plate fitted into the bottom of a tub.* The sweepings being put into the tub with a quantity of mercury and water, the powder passing successively under the iron bars, is ground, and brought into contact with the quicksilver, which by degrees extracts the gold; while the water, which, after a certain time, is suffered to run off through a small quill, fixed in a hole made in the side of the tub, carries with it the lighter earthy matter:† fresh water is supplied, till all the earth is thus washed off. The operation might, doubtless, be expedited by the use of heat, as in the above process of Barba.

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* Three of these mills are now used together, a bar of wood with holes made through it, which receive the three handles into them, giving motion to all the three mills, which are placed in a straight line, at once. The late Mr. Nicholas Paul informed the Editor, that a mill was established at Geneva, for washing the goldsmiths' and jewellers' sweepings, *gratis.* It consisted of a flat circular ring of cast-iron, placed horizontally, and having a circular groove or channel, in which two heavy cast-iron runners were made to turn by the power of horses. The sweepings being put into the channel with mercury, water was made to enter the channel on one side, and pass off on the other side, continually, during the action of the machine. We said the proprietors professed to grind the sweepings *gratis;* but, in fact, the water carried off with it into proper receptacles, placed in an adjoining room, so much gold, as to render the concern *a highly lucrative one.* If we are not mistaken, a similar machine is, or at least was, established by foreigners in London, some time since.—*Editor Tech. Rep.*

† And possibly some of the gold also; see the foregoing note.—*Editor T. R.*

The gold being by these means transferred into the mercury, and the mixture washed clean, as much as may be of the mercury, is pressed out through leather, and the remainder forced off by fire. To collect the exhaling mercury, a head and receiver are fitted to the iron pot, in which the mass is exposed to the fire. Barba advises the pot to be lined with a mixture of clay and sand, to prevent the gold from adhering to, or dissolving a part of, the iron, in case the fire should be raised so far as to make the gold melt.*

It is scarcely to be expected, that the greatest address of the workmen can collect, either by water or mercury, the whole of the gold diffused through a large quantity of other matter, at least when the mercury is used, as it is in the large way, in so small a proportion as a 100th or 200th part of the weight of the earthy powder. Reaumur, after having worked some gold-sand with mercury, in the methods commonly practised by those who wash the sands of rivers, obtained from the remaining sand, by treating it with a double quantity of mercury, near as much gold as he had done the first time.

On the extraction of Gold, intimately combined in the composition of Sands.

For extracting gold from the ferruginous sands, mentioned in the preceding part of this article, the sand is to be made red-hot, and quenched in water, and the ignition and extinction repeated four times, or oftener. The colour changes from yellow, red, or black, to a reddish brown. In the first and second heating, the sand yields a slight smell, somewhat like that of garlic, a mark of its containing arsenic: at the third time, the arsenical smell is scarcely to be perceived; but on throwing into the crucible a little tallow, or other like inflammable matter, it becomes stronger than before: this remarkable circumstance is by no means peculiar to these sands, for there are several arsenical minerals, which give little of their arsenic in the fire, till some inflammable matter is added. The sand, thus calcined, is mixed with twice its weight of granulated lead, and equal its weight of black flux; the mixture put into a crucible, and covered with some sea-salt, dried over the fire until it has ceased to crackle. The crucible is placed in a good blast-furnace, the fire strongly excited, and the matter stirred from time to time with an iron rod: the fire must be urged till the scoria flows thin as water, which is known by the rod coming out almost clean, without the least knob sticking to the end of it. The crucible is then suffered to cool, and broken, for getting out its contents: on the top is the common salt, in a distinct cake; under this, a shining, black, compact, vitreous scoria; and at the bottom, a lump of lead, easily separable from the scoria. The gold contained in the sand, is now transferred into the lead, and may be separated by working off the lead upon a cupel or test. These sands contain also silver, which here accompanies the gold, and which may be parted after the cupellation, either by *aqua-fortis* or *aqua-regia*, according as the one or the other metal appears to prevail in the mass. This is the process followed by M. Lieberecht, in the assays already given an account of.

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* This advice of Barba is adopted in the Royal Mint, in the *cast-iron crucibles* used for melting gold and silver in, with great economy.—*Editor T. R.*

As the black flux (which consists of one part of nitre, and two or three of tartar, mixed together, and burnt in a covered vessel to a black alkaline coal,) is apparently too expensive to be employed for any considerable quantities of the mineral, its place may be supplied by a mixture of potash, or other fixed alkaline salts, with powdered charcoal. Four parts of potash, three of charcoal, and thirty-two of lead, are sufficient for sixteen of the calcined sand. This mixture, as Hellot observes, requires the fire to be continued longer than the preceding, to make the matter equally fluid, but when it is made so, the yield is found to be in both cases alike.

The same end may be obtained also, by boiling the calcined sand in melted lead, without any inflammable or saline addition. For the vitreous matter, into which the lead is gradually converted, will dissolve the earth, and the unvitrefied part of the lead will receive and collect the gold; but a much larger quantity of lead is requisite in this than in the other ways.

In all the foregoing methods, though the quantity of gold obtained is considerable, much still remains in the scoriæ, for want, probably, of a thorough commixture of them with the lead: for whatever degree of fluidity the scoriæ are brought to, the particles of gold are too minute to subside by their own weight, and the lead can collect them only from those parts which it comes in contact with. It may, therefore, be presumed, that the separation will be the more complete, as the commixture of the lead is the more perfect. Lead cannot be mixed perfectly with sands, but in a vitreous or semi-vitreous form. By grinding the calcined sand with litharge, or other calces of lead, and exposing the mixture to a moderately strong fire, they may be intimately united into a uniform glassy compound, the sand being dissolved by the vitrefied lead, nearly as salt is dissolved by water. On adding to this compound, a little powdered charcoal, or barely stirring it with an iron rod, the lead revives, and falls to the bottom; and as the sand has there been in contact with every part of it, the gold will probably be extracted from every part, at least, more effectually than by the other methods. In this way, it will be proper to mix some alkaline salt with the litharge and sand; partly to promote the dissolution of such portion of the sand as floats on the top of the ponderous metallic preparation, and partly to continue the fluidity of the scoria, after the revival of the lead. The crucible may be made of Stourbridge clay, which seems to be one of the best of the common materials for resisting glass of lead in fusion. It appears to have been on a process of this kind, that Becher's proposition to the States of Holland was founded, for extracting gold with profit from common sands; it is plain, from his account of the affair, in his *minera arenaria*, that he vitrefied the sand with glass of lead, or litharge; and he expressly mentions in one place, the precipitation of the lead from the glass by iron: he used also an addition of silver in great proportion, for imbibing the gold, and thus required a vast capital for establishing a work in large; but where the lead is to be revived, the silver is rather detrimental than useful; for the gold and silver contained in the sand are imbibed by the lead, and the additional silver occasions an enormous expense of *aqua-fortis* for dissolving it, in order to the separation of the gold. Whether, with this reduction of the expense, of which Becher himself seems to have had some idea, the process might be practicable to advantage, or whether some earthy bodies might not be a useful auxiliary for promoting the fusion of the gold sands, may deserve further inquiry: one kind of earth is frequently observed to bring another into fusion, though both are of themselves unfusible; and the earthy parts of different ores are made fluid in the furnace of the smelter, by the addition of other earths.

On the extraction of Gold from the Ores of other Metals.

When gold is intimately combined with other metals in their ores, the ore is to be run down in the same manner as the same kind of ore without gold. The gold commonly melts out with the proper metal of the ore, from which it may be afterwards separated by different processes, according to the nature of the metal. There are grounds to believe, that most metalline bodies, as extracted from their ores, contain generally a portion of gold, though rarely sufficient to bear the expenses of its separation.

Zinc, arsenic, and mercury, are obtained from their ores by a kind of sublimation: hence, if the ores of these contain gold, the gold is to be sought for, not in the metallic substance separated, but in the remaining matter. There are some other cases also, in which the gold, instead of accompanying the metal in its fusion, is thrown off in the slag: but the ores and slags of this kingdom have been so seldom examined for gold, that I can say but little satisfactory on this subject.

ON ENGRAVING.

(From the Mechanics' Gallery. By C. F. Partington.)

(Continued from p. 165.)

Engraving in Mezzotinto.

Notwithstanding the great difference in the works of the *mezzotinto* engravers, their operations are nearly the same. The plate must be prepared and polished in the same manner as for other work; and afterwards divided equally by lines parallel to each other, which are to be traced out with very soft chalk. The distance of these lines should be about one-third of the length of the face of the cradle, or grounding tool, which is to be used; and they should also be marked with capital letters, or strokes of the chalk to distinguish them from one another. The cradle is then to be placed exactly betwixt the two first lines, and passed forwards in the same direction with them, being held as steady as possible, and pressed upon with a moderate force, rocking it from end to end, till it has completely hacked all that part of the plate between those two lines. The same operation must be repeated with respect to all the other lines, till the instrument has passed over the whole surface of the plate, and rendered it uniformly rough throughout. Other lines must be then drawn from the extremities of the other two sides, in the same manner, and at the same distance from each other, as the first set of lines; these lines intersecting the first at right angles, will, with them, form squares. The same operation must be repeated with the cradle, between this second course of lines, as in the case of the first. New lines must then again be drawn diagonally to the former, and, bisecting the aforesaid squares, and the cradle passed betwixt them as before: when the first diagonal operation is performed, the diagonal lines must be crossed at right angles by other lines, as the former, and the cradle passed betwixt them in the same manner. The plate having undergone the action of the cradle, according to the disposition of the first order of lines, as above, a second set of lines must be formed, having the same distances from each other as the first. But they must be so placed as to divide those already made, into spaces one-third less than their whole width; *i. e.* every one, after the first on each side, will take in one-third of that before it; *e g* beginning at A, of which the first third must be left out; a third of B will consequently be taken in, and so of the rest. These lines of the second order must be marked with small letters, or lesser strokes, to distinguish them from the first: and another ground must be laid on the plate, by hacking it with the grounding-tool, between each two of the second order of lines. When this second operation is finished, a third order of lines must be made; the first of which, *e g* in A, must omit two-thirds of it, and consequently take in two-thirds of B, &c. By these means the original spaces will be exactly divided into equal thirds; and the cradle must be again employed betwixt these lines as before. When the whole of this operation is finished, it is called *one turn;* but, in order to produce a very dark and uniform ground, the plate must undergo the repetition of all these several operations for above twenty times; beginning to pass the cradle again betwixt the first lines, and proceeding in the same manner through all the rest. The plate being thus prepared with a proper ground, the sketch of the design, or outline, must be chalked on it, by rubbing the back of the paper, or drawing with chalk, and tracing the outline with a pointer, as in etching. It is also proper to overtrace it afterwards with black lead or Indian ink, to have a more distinct and permanent sketch. The scraping is then performed by pairing or scraping away the grain of the ground in various degrees, so that none of it is left in the original state, except in the touches of the strongest shade. The general method of proceeding is similar to that of drawing with white, upon black paper. The masses of the strongest light are first begun with, and scraped pretty smooth; and some parts, where there is no shade, as the tip of the nose, &c. are burnished, and those parts which go off into light in their upper part, but are brown below. The next lower gradations of shade are then scraped down, after which the reflected lights are entered upon: the plate is next to be blackened with a printer's blacking ball, made of felt, in order to discover the effect: and then the work is proceeded with again, observing always to begin every part in the places where the strongest lights are to be introduced.

J. C. Le Blon, of Frankfort, pupil of Carlo Marata, applied this art to the method of printing with different colours, to produce the resemblance of paintings. He considered all colours as composed of three primitive ones: the combination of two of these, he asserted would produce a third, such as their compound must necessarily give, and the two primitive colours would preserve their original colour: but if transparent colours be mixed, and three primitive ones combined together, they destroy each other, and produce a black, or a colour approaching towards it, in proportion to the equality or inequality of the mixture: and if these three colours be laid either separately, or upon each other, by three plates, engraved correspondently, on these principles, to the colouring of the design, the whole variety of tints necessary may be produced. The requisites, therefore, to the execution of any design in this method of printing are the following: —1. To settle a plan for the colouring to be imitated, showing where the presence of each of the three simple colours is necessary, either in its pure state, or combined with some other, to produce the effect required; and to reduce this plan to a painted sketch of each, in which not only the proper outlines, but the degree of strength should be expressed. 2. To engrave three plates, according to this plan, which may print each of the colours exactly in the places where, and in the proportion in which they are wanted. 3. To find three transparent substances proper for printing with these three primitive colours. The manner in which M. Le Blon prepared the plate was as follows:—The three plates of copper were first well fitted, with respect to size and figure, to each other, and grounded in the same manner as those designed for mezzotinto prints: and the exact place and boundary of each of the three primitive colours, conformably to the design, were sketched out on three papers, answering in dimensions to the plate. These sketches were then chalked on the plates; and all the parts of each plate, that were not to convey the colour to which it was appropriated to the print, were entirely scraped away, as in forming the lights of all mezzotinto prints. The parts that were to convey the colours were then worked upon, and where the most light or diluted tints of the colour were to be placed, the grain in the ground was proportionally taken off; but where the full colour was required it was left entire. In this method of printing regard was had not only to the effects of the colour in its simple state, but to its combined operation, either in producing orange colour, green, or purple, by its admixture with one alone; and likewise to its forming brown, gray, and shades of different degrees, by its co-operation with both the others. But though the greatest part of the engraving was performed in the mezzotinto manner, yet the graver was employed occasionally for strengthening the shades, and for correcting the outline, where it required great accuracy and steadiness. It was found necessary, sometimes, to have two separate plates for printing the same colour, in order to produce a stronger effect: but the second plate, which was used to print upon the first, was intended only to glaze and soften the colours in particular parts that might require it. With respect to the black and brown tints, which could not be so conveniently produced, in a due degree, by the mixture of the colours, umber and black were likewise used. From some specimens of this invention, left us by the above artist, and cotemporary accounts of his success, we have reason to believe he met with less impediments in his work than many of his successors; but with respect to the order in which the plates are to be applied, it may be proper to observe, that the colour which is least apparent in the picture should be laid on first; that which is betwixt the most, and least apparent, the next; and that which predominates, last; except where there may be occasion for two plates for the same colour, as was before mentioned; or where there are any more plates required for adding browns and shades.

The above-named ingenious artist, applied this art not only to general subjects, but also to portraits, and showed, by the specimens he produced, the possibility of its being, by further improvements, rendered capable of affording very exact imitations of painting, which might have some value. It must, however, be confessed, that it is much better adapted to the simpler subjects, where the colours are less compounded and intermixed, and where the accuracy of the reflections and demi-tints do not form an essential characteristic; and, in general, it may be observed, that those mezzotints which have their outlines finished with the graver are better adapted to this mode of painting than plates wrought with the scraper and burnisher only. M. Cochin observes, that "though Le Blon confined his method principally to the use of three colours, yet, should this invention be again taken up and cultivated, there would be more probability of success in using a greater variety: and that several different kinds might be printed by one plate, provided they were laid on in their respective proper places by printing-balls, which should be used for that colour only.

(TO BE CONTINUED.)

Progress of manufactures and other improvements in New Hampshire.

PORTSMOUTH, N. H. Aug. 19.

In 1810 there were in New Hampshire but 12 manufacturing establishments, with 5956 spindles; and the whole amount of woolen, cotton, flaxen and tow cloth manufactured by them, and by families throughout the state in that year, was only 4,274,185 yards. There are now in this state more than *fifty* cotton and woolen factories, and the amount of cloth manufactured annually, cannot be far from 30,000,000 yards. Some of the towns in the vicinity of Portsmouth have within a few years been wonderfully changed from agricultural to manufacturing pursuits. The factory establishments of Newmarket, Dover, Somersworth, Berwick, &c. have made our neighbourhood a manufacturing district, and the future good or bad effects of this pursuit, must in time have a great influence upon our prosperity.

In 1822, that part of Somersworth called Great Falls, contained but *two* dwelling houses. Now the eyes of the visiter are greeted with a pleasantly situated, and beautiful village, of between sixty and seventy buildings, chiefly erected within the last two years, either built of brick, or painted, and many of them of the same size and appearance, laid out with so much regularity, that if exhibited in a picture, it would partake too much of formality to appear natural. This is exclusively a manufacturing village—nothing is to be seen but what has some relation to the establishment.

Here are four factories—one for cotton, built of wood, 5 stories (including basement and attic,) 35 feet wide and 65 feet long, containing 1500 spindles, and manufactures 7000 yards No. 20 cotton cloth weekly.

One of brick, 5 stories, 45 by 156 feet, containing nearly 6000 spindles, and will manufacture from 16,000 to 18,000 yards No. 40 cloth per week.

One of Brick, 6 stories, 49 by 220 feet, exclusively for broadcloths.

One recently erected, of brick, 6 stories high, 49 by 390 feet, for cotton and woolen manufacture. This is the most extensive building devoted to the manufacturing purposes in New Hampshire, if not in N. England.

There is also a building of brick, 4 stories high, 32 by 134 feet, occupied as a dyehouse for the manufacture of carpets, &c., another house of brick, 3 stories, 28 by 100 feet, for drying. A building of brick, 35 by 65, for trip hammers and machine shops. There is also an extensive range of work shops; 40 dwelling houses of wood, 2 stories high, 24 by 40 feet; 5 extensive boarding houses: 5 brick blocks, of 30 by 80 feet each, 3 stories; and a great number of buildings occupied by mechanics. A spacious and elegant brick hotel, 3 stories high, has also been erected, where the traveller meets with good accommodations.

The village contains about 1500 inhabitants—about 1000 of whom are enrolled in the factory books. This establishment is situated on Salmon Falls river, about three miles from tide waters.—The resources of the river are abundant, having extensive ponds for reservoirs. The fall at the control of the Great Falls Company is 120 feet, and only about one-sixth of the power will be used for the factories now built.

Essays on Bleaching. *By* JAMES RENNIE, A. M. *Lecturer on Philosophy, &c. &c. London.*

No. I.—HISTORY OF THE ART.

Section II.—THE art of bleaching was known to our ancestors in Britain as early, at least, as the first century, as we are informed by Pliny, (Hist. Nat. lib. XXX. *c*. 50.) who tells us, "that the flax, after being spun into yarn, was pounded several times in a stone mortar with water; and when it was woven into cloth, it was beaten again upon a smooth stone, with broad headed cudgels; and the more frequently this process was repeated, the whiter and softer the cloth became." A more accurate description could not be given, of a process which every Scotsman, who has lived in the country, must have seen employed by the peasants of the present day. This simple process, however, is aided by boiling with soap or kelp, and by crofting; but even in Pliny's time, they had recourse to vegetable alkalies, as he tells us, in the following book, that the process was much facilitated by macerating in the water the roots of a kind of wild poppy, which was much sought after for this purpose, and made the linen look "wonderfully pure and white." Might not this wild poppy be the cuckoo pint, (*Arum maculatum*, Lin.) which even in modern times has been used in bleaching in France and other parts of Europe? (Parkes' Chem. Ess. IV.) We are told by Lewis, (Newman's Works, II. p. 226.) that the juices of this plant have the property of destroying the resinous colouring matter of vegetables; but I think the effect might be better accounted for by a peculiarity in this plant, first observed by Lamarck and Sennebier, namely, that it contains a greater quantity of sensible heat than any other plant whose temperature has been examined. (Smith's Intr. to Bot.) The use of plants in bleaching is not peculiar to Europe. The Indians in North America, as M. De Lery tells us, make a detergent water from certain fruits, with which they wash and bleach their cotton beds and garments. (Voyage de J. De Lery, p. 276.) It is likely that he here alludes to the fruit of the Myrica Cerifera, of the mode of making soap from which, M. Cadet gives an excellent account in the Annales de Chimie. Dec. 131.

We need not wonder that attention would be paid to this art among the Greeks and Romans, when we are aware of the delicate fineness to which they brought their linen cloth, and the value at which certain sorts were estimated. We are informed by Pliny, that a kind of lawn, made from the flax denominated Byssus, which grew in Achaia, was so much esteemed in the first century as an ornamental dress, that it was sold for its weight in gold. We are at no loss from this to see, why its use was considered, by some austere Romans, as a mark of unpardonable luxury and effeminacy, (Hist. Nat. lib. II. *c.* 1.;) and the same author tells us, that the threads of the Retovine linen are evener, if evener may be, than that of a spider: he himself had seen so fine and small a thread of Cumes flax, that a whole net knit of it would pass through the ring of a man's finger; and he had seen also some so fine, that one man could easily carry as much yarn as would go round and compass a whole forest. But the *finest cloth*, he says, (lib. XII. *c.* 10.,) which was made in his time, was manufactured from the cotton which grew in India and Persia. There was a great difference, however, in the whiteness of the several sorts of linen, either from the mode of bleaching, or from the nature of the materials. The Faventine, for example, was always whiter than the Allian, which was commonly brown before it was bleached. Pliny likewise gives an account of the earths and plants employed by the Romans in bleaching and washing; but it is likely that these methods were soon improved after his time, as we know that the manufactory of soap contrary to the assertion of Beckman, was carried on to some extent in Italy; and it is not long since a complete manufactory for boiling soap was discovered in the subterranean Ruins of Pompeii. This soap had been made by combining alkalis with an oil. (See Starke's Letters from Italy.) Immediately subsequent to the time of Pliny, the Romans indulged in what their fathers had considered to be effeminate; and white cloaks of linen were almost universally worn. (Beckman's History of Inventions, III. p. 270.) May we not then consider it rather as a poetical flourish than a correct description. which we find in Valerius Flaccus. of the dress of a warrior who was slain at Colchis during the Argonautic expedition; especially when we consider, that this author lived near the time of Pliny, when linen was still of inestimable value? The passage runs thus:

> Cadit——Taulantis alumuus——
> *Tenina* non illum *candentis carbasa lini,*
> Non auro depicta chlamys, non flava galeri
> Cæsaris, pictoque juvant subtemine bracal.
>
> *Val. Flaccus,* VI. 221.

We cannot however distrust an eye witness:

> ᾿Επορευθησαν δια Χαλυβων—ειχον δε θωρακας λινȣς μεχρι τȣ ητρȣ.
>
> *Xenoph. Anab.* IV.

The preceding notices, it must be confessed, are scanty and imperfect; but they are all which I have been able to collect from my limited acquaintance with antiquities. In the ages which succeeded those of which we have now been speaking, our information upon this, as upon almost every other topic, is altogether imperfect. It is probable that the art in question, remained nearly as it had been transmitted to the people of the middle ages from the ancients. This amounts nearly to a certainty, when the earliest of our modern processes are compared with what we know of antiquity. In Iceland, which, from its remoteness, we may suppose comes but accidentally acquainted with the improvements made in the other parts of Europe, they bleach with a ley made of ashes and urine. (Hist. de l'Islande, I. 266.)

The earliest account which has come to my knowledge of the mode of bleaching in modern times, is given in a book now become scarce, but a copy of which I was so fortunate as to procure from Stirling's Public Library; it is entitled, "Select Essays on Commerce,' &c. (8vo. Lond. 1754.) The mode of bleaching there described, was practised in Holland and Flanders, and consisted in souring with milk or bran, in boiling with alkaline leys, and in exposing the goods for a whole summer to the sun and air. This book, however, must be comparatively modern with the processes it describes; for long before this we find "*Holland* white as snow" mentioned in our old ballad poetry. There are indeed few of our oldest ballads and traditionary legends which do not mention shirts and other garments made of "Holland fine." The Dutch and Flemish process being unknown in the other parts of Europe, it began to be supposed that there was something in the air or the water of Holland which produced linen of so clear a white; and the adjacency of the sea was mentioned as one of the causes of this. All the bleaching grounds in Holland, indeed, were situated near the sea, as it had been found by experience that the sea air seemed to produce a fairer white, than that farther inland. If the cause of this had been inquired into with any degree of philosophical acuteness, it might have led rapidly to the unexampled chemical improvements which have been lately made in the art of bleaching. But the period of which we speak, was only the dawn of the philosophical arts. Every process was conducted by blind precedent, without the slightest hint ever intruding itself *why* such things were done. But this dawn, faint as it was, soon brightened into all the splendours of noon-day; and if I am not misinformed, the world is indebted to Scotland for the first application of chemistry to the art of bleaching.

Two years after the publication of the Select Essays, Dr. Home, the Professor of Chemistry in the University of Edinburgh, published his inestimable Experiments on Bleaching, in which he proved that employing oil of vitriol (sulphuric acid) for souring linen goods was both more economical, more efficacious, and less liable to uncertainty than the Dutch mode of souring with milk or bran. Previous to Dr. Home's experiments, the art of bleaching was quite in its infancy in Britain. Even so late as 1752, British linens were sent to Haarlem to be bleached at a considerable expense and much loss of time. The Dutch process is commonly supposed to have first been practised by the Scotch; but it was certainly first known to the Irish. The Scotch linens were usually sent over to Holland in March, and were not returned in a finished state till October following, when they were sent to the London market under the name of Scotch Hollands. On the authority of Patrick Milne, Esq. M. P., Mr. Parkes states, (Chem. Es. IV. p. 18,) that an Irishman who had learned something of bleaching, settled, in 1749, in the North of Scotland, and was entrusted with the linens to bleach which had formerly been sent to Holland. His first attempts, however, were unsuccessful, and after he had done his utmost, the Goods had to be sent to Holland to be finished. But several years' inquiry and experience made him an excellent bleacher, and by assiduously practising the art, he soon realized an opulent fortune. At the same time the Scotch manufacturers were greatly benefited by having their goods sooner ready for the market, and their capital more quickly circulated. Dr. Home's improvements, which immediately followed this, gave our countrymen a decided superiority in this art, and the North of Scotland soon stood as high as Holland and Flanders had previously done.

In order to show the advantages of Dr. Home's improvements, it may not be out of place to give an account of the mode which was previously followed, a little more in detail. For this purpose, I shall select the process for bleaching linen yarn, which was very operose, and required four times the expense of cotton yarn; inasmuch as the colouring and resinous matter is in much greater quantity in the former. Most sorts of linen yarn, for example, will lose 27 per cent. of their original weight before they are thoroughly bleached, while cotton yarn will lose only 4½ or 5 per cent. by the same process. The following account is given by Parkes, of the mode of bleaching linen yarn about half a century ago. The brown yarn was first immersed in hot water for three or four days, or macerated in cold waste alkaline leys for about forty-eight hours, which by producing a fermentation in the vegetable substance, or otherwise acting chemically upon the fibres, loosened the saliva of the spinner, or such foreign and heterogeneous matters, and rendered them easy to be removed by simple washing. The yarn was next boiled and steeped in alkaline ley, the apparatus being so contrived that the ley was poured over the goods, through which it percolated till it reached the bottom of the vessel, whence it was drawn off into a heated copper; and from this again it was pumped back over the goods, and so on alternately and uninterruptedly for many hours. The yarn was then well washed and exposed on the grass for two or three weeks. It was now bucked again, washed, and crofted as before; and these processes were alternately continued four or five times, the strength of the ley being gradually reduced in each successive bucking. After the yarn had been bucked four or five times, it was immersed in soured milk, in which it lay two or three weeks, till the scum, formed by the matters disengaged by fermentation, began to crack and subside. The yarn was then taken out of this *first sour*, and well washed; and the processes of bucking, washing, crofting and souring, were alternately repeated till it was thought to be clean and of a good colour. For cleansing and finishing they employed soap, which renders the goods soft and delicate, and makes them handle better than when they are simply washed in pure water. Now, from this account it is evident, that the old mode of bleaching was extremely tedious, troublesome, and liable to great uncertainty of result. If goods were sent to the field in March, they were not ready for the market before September; and if at midsummer, they could only be half-bleached that year; because it was found, that crofting succeeded best in the spring, and when any were unfinished in autumn, they were laid aside till March following.

The improvements of Dr. Home, then, were of great importance in saving time; for, by making the sours of sulphuric acid, instead of milk, the process of souring, which formerly took two or three weeks at each repetition, could be finished in as many hours. A great deal of trouble was also saved; for great quantities of milk being requisite, it could not easily be collected, and carried from great distances to the manufactory, as would frequently be necessary. The expense, likewise, of sulphuric acid, was considerably less than that of milk, owing to the improved process which was about this period invented by the ingenious Dr. Roebuck, for the extensive manufacture of this acid.* They found that sours composed of it, acted with more certainty and effect; while they did not, in the least, injure the fabric of the cloth. A prejudice long subsisted, indeed, which is not even yet wholly removed, that the fabric is weakened by vitriol sours; but Dr. Home proved, in the most satisfactory manner, by repeated experiments, that it is altogether unfounded. He kept, for example, a piece of linen in a strong sour of vitriol during several months, and the fabric of the cloth remained as firm and strong as before it was immersed. Even in the present improved state of chemical bleaching, this improvement of Dr. Home's is of importance, and is still used in conjunction with those which are much more powerful.

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* The first large leaden chamber for this purpose, was erected by him at Birmingham, in 1746; and, in three years afterwards, he established extensive

(TO BE CONTINUED.)

On the Nature and Properties of Timber, extracted from "The Elementary principles of Carpentry, by THOMAS TREDGOLD."

(Continued from page 178.)

Effect of continued Moisture with Heat.

Wood, in common with other vegetable products, when exposed to a certain degree of moisture, and at a temperature not much under 45 degrees, nor too high to evaporate suddenly all the moisture, gradually decomposes. This decomposition is called putrefaction by chemical writers, but is called the *rot* in common language. It proceeds with most rapidity in the open air, but the contact of air is not absolutely necessary. Water is, in all cases, essential to the process; indeed, it is a principal agent in all processes of decomposition.

As the rot goes on, certain gaseous matters are given out; chiefly carbonic acid gas and hydrogen gas.

Pure woody fibre, alone, undergoes this change slowly; but its texture is soon broken down, and it is easily resolved into new elements, when mixed with substances more liable to change. "Any process," observes Sir H. Davy, "that tends to abstract carbonaceous matter from it, must bring it nearer in composition to the soluble principles," and this is done by fermentation. Hence it is, that the sap-wood is of a more perishable nature than the heart-wood; for the sap-wood abounds more in saccharine and fermentable principles, and, consequently, sooner ferments. Dr. Darwin took part of the branch of an oak tree, cut in January, and divided it carefully into three parts, the bark, the alburnum, or sap-wood, and the heart-wood. These were each shaved, or rasped, and separately boiled in water, and then set in a warm room to ferment. The decoction of the sap-wood passed into rapid fermentation, and became acid; but not either of the others.

Duhamel tried some experiments to ascertain the effect of confining the sap in green timber; and found, that the pieces thus confined soon exhibited signs of rapid decay; and, therefore, he strongly recom-

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works on the same plan at Prestonpans, whence he supplied not only bleachers and other manufacturers of Scotland and Ireland, but also those on the continent, who soon learned to prefer it to milk sours.—*Parkes.*

mends a free space for the circulation of air round the ends of joists and beams, instead of building them in the wall. Duhamel also tried the effect of covering the external surface of timber with paint, tar, and pitch; and found that it contributed much to the durability of dry or well-seasoned timber, but hastened the decay of green and unseasoned timber.

Quicklime, when assisted by moisture, has a powerful effect in hastening the decomposition of wood, in consequence of its abstracting carbon. Mild lime (carbonate of lime) has not this effect. But mortar requires a considerable time to bring it to the state of mild lime; therefore, bedding timber in mortar, or building it in walls, where it will long remain in a damp state in contact with mortar, is very injurious, and often the cause of rapid decay. Wood in a perfectly dry state, does not appear to be injured by dry lime; of this we have examples in plastering laths, which are generally found sound and good in places where they have been dry. Lime also protects wood from worms.

Volatile and fixed oils, resins, and wax, are equally as susceptible of decay as woody fibre under the same circumstances; hence we see the impropriety of attempting to protect wood in any situation where the coat of paint, &c. cannot be renewed from time to time; and also, that woods abounding in resinous matter, cannot be more durable than others.

Decay sometimes commences in the growing tree; for when it has stood beyond a certain age, decay at the heart has generally made some progress. I have often observed this in large girders of yellow fir, which have appeared sound on the outside, but, by removing some of the binding joists, have been found completely rotten at the heart. It is on this account, that the practice of sawing and bolting girders is recommended.

It is usual to divide the rot into two kinds, the *wet rot*, and the *dry rot;* but I have not been able to discern any real distinction between them, except that in the one, the gaseous products are evaporated, and in the other, the greater part of them run into a new combination, which is a species of fungus. Both, in a chemical sense, are produced by precisely the same causes, with this exception, that a free evaporation determines it to be the wet rot; a confined place, or imperfect evaporation, renders it the dry rot, as timber must be decomposed before it can become the food of a plant: they are evidently the same with the putrefaction of chemists. It is said, that the decay of a post, placed in the ground, or in water, is an example of the wet rot; and it is assumed, that the parts undergoing the process of decay, are alternately wet and dry; but the fact is, they are constantly supplied with that degree of dampness which is essential to putrefaction. For "timber being composed longitudinally of an assemblage of pipes or tubes, it is only necessary that one end of a log of wood should be placed in a damp or wet situation to occasion the moisture to be conveyed to the opposite end by capillary attraction." Prevent a free change of atmospheric air, and a post so circumstanced, it is well known, would be affected with the dry rot. Hence it appears to me, that some writers are mistaken in asserting, that they are "essentially different, both in the symptoms, the progress, and the causes."

When only the external part of a beam has been seasoned, and the sap has never been evaporated from the internal part, the rot will be an internal disease; and where an internal decay of this kind is found, it proves that the timber has never been properly seasoned. Mr. Bowden, in the plate to his Treatise on the Dry Rot, gives figures of such a piece; it appears to be of common occurrence; and it is evident from such examples of decay, that the want of due time and attention in seasoning, is one of the chief causes of the rapid decay of ships. In Mr. Bowden's specimen, the exterior part, to the depth of two inches from the outside, was as sound as any wood could possibly be; but the central part was filled with a fine, white, thread-like vegetation, extending within the above-mentioned two inches of the exterior surface, and uniting in a thick, fungous coat, at the end of the piece; thus showing the depth to which the seasoning had been effected.

In the first stages of rottenness, the timber swells, and changes colour, is often covered with mucor, or mouldiness, and emits a musty smell. Where the rottenness is internal, or the timber is in a confined place, a new substance is formed between the fibres, of a spongy consistency, resembling the external coat of a mushroom; and the substance itself has been ascertained to belong to the order fungi, of the cryptogamia class of plants.

When the fungus first appears on the sides and ends of timbers, it covers the surface with a fine, delicate vegetation, that has been called by shipwrights, a mildew. These fine shoots afterwards collect together, and the appearance then may be compared to hoar-frost, and increases rapidly, assuming gradually a more compact form, like the external coat of a mushroom, but spreads in the form of leaves, being larger or smaller, most probably, in proportion to the nutriment the wood affords. The colours of the fungus are various; sometimes white, grayish white, with violet; often yellowish brown, or a deep shade of fine rich brown.

It has been considered a question of some importance, to determine how fungi are propagated, or from what they originate; but as such an inquiry can be attended with little, if any, advantage, in preventing the rot, it appears to be better to consider it only so far as it is a chemical change, leaving the question of their origin to the curious, as well as the distinction of the species of fungi.

In the more advanced stages, the woody fibres contract lengthwise, and show many deep fissures across the fibres, similar to a piece of wood scorched by the fire. The woody fibres appear to retain their natural form, but easily crumble into a fine powder. In oak, this powder is of a fine, snuff-brown colour.

The fungus, when it spreads upon the surface of the wood, often becomes of a considerable size, sometimes spreading over the adjoining walls, and ascending to a considerable height.

The decayed state of a barn floor is thus described by Mr. B. Johnson: "An oak barn floor, which had been laid twelve years, began to shake upon the joists, and on examination, was found to be quite rotten in various parts. The planks, 2½ inches in thickness, were nearly eaten through, except the outside, which was glossy, and apparently without blemish. The rotten wood was partly in the state of an impalpable powder, of a snuff colour; other parts were black, and the rest clearly fungus. No earth was near the wood.

In timber of the same kind, that of the most sappy and rapidly grown trees is the most subject to decay. The wood of trees from the close forests of Germany, or America, is more subject to it than that of trees grown in more open situations; and it is remarked by Mr. Barrow, that "the timber brought from America in the heated hold of a ship, is invariably covered over, on being landed, with a complete coating of fungus." Consequently, the timber must be infected with the seeds of decay before it is brought into use. Also, the custom of floating timber in docks and rivers injures it very much; it would be better to sink it completely under water, as to half immerse it in water is the worst situation it can be placed in.

Though moisture be essential to the progress of decay, absolute wetness will prevent it, especially at a low temperature. In ships, this has been particularly remarked, for that part of the hold of a ship which is constantly washed by the bilge-water, is never affected by dry rot. Neither is that side of the planking of a ship's bottom which is next the water, found in a state of decay, even when the inside is quite rotten, unless the rot has penetrated quite through from the inside.

Warmth and moisture are the most active causes of decay, and, provided the necessary degree of moisture be present, the higher the heat, the more rapid is its progress. In warm cellars, or in any close confined situations, where the air is filled with vapour, without a current to change it, the rot proceeds with astonishing rapidity, and the timber-work is destroyed in a very short time. The bread-rooms of ships, behind the skirtings, and under the wooden floors of the basement stories of houses, particularly in kitchens, or other rooms where there are constant fires, and, in general, in every place where wood is exposed to warmth and damp air, the dry rot will soon make its appearance.

All kinds of stoves are sure to increase the disease, if moisture be present. The effect of heat is also evident from the rapid decay of ships in hot climates. And the warm moisture given out by particular cargoes, is also very destructive; such as cargoes of hemp, pepper, and cotton.

Building timber into new walls, is often a cause of decay, as the lime and damp brick-work are active agents in producing putrefaction, particularly where the scrapings of roads are used instead of sand for mortar. Hence it is, that bond-timbers, wall-plates, and the ends of girders, joists, and lintels, are so frequently found in a state of decay. The old builders used to bed the ends of girders and joists in loam, instead of mortar, as is directed in the act of parliament for rebuilding the city of London. In this place it may not be amiss to point out the dangerous consequences of building walls, so that their principal support depends on timber. The usual method of putting bond-timber in walls, is to lay it next the inside; this bond often decays, and of course leaves the wall resting only upon the external course or courses of bricks; and fractures, bulges, or absolute failures, are the natural consequences. This evil is in some degree avoided, by placing the bond in the middle of the wall, so that there is brick-work on each side, and by not putting continued bond, for nailing the battens to.

But if the powerful lateral pressure of flat arches were avoided, so many ties, or bond-timbers, would not be necessary. The improper use of arches produces more fractures in buildings than any other cause. Nothing can be more absurd than the construction of the fronts of London houses; they exhibit a continued series of stretchers and ties. Each range of arches is a line of stretchers, and the bond and wall-plates are the ties; and as the arches are close-jointed and well fitted on the outside, but open jointed and indifferently built in the inside, when the building settles, it has a strong tendency to bulge outwards. Thus timber ties are necessary to secure an ill-constructed wall, which consequently cannot be more durable than the timber.

As an example of the danger of trusting to timber in supporting heavy stone or brick-work, the failure of the curb of the brick dome of the church of St. Mark, at Venice, may be cited. This dome was built upon a curb of larch timber, put together in thicknesses, with the joints crossed, and was intended to resist the tendency which a dome has to spread outwards at the base. In 1729, a large crack and several smaller ones were observed in the dome. On examination, the wooden curb was found to be in a completely rotten state, and it was necessary to raise a scaffold from the bottom, to secure the dome from ruin. After it was secured from falling, the wooden curb was removed, and a course of stone, with a strong bond of iron, was put in its place.

The bad effects resulting from damp walls, is still farther increased by hasty finishing. To inclose with plastering and joiners' work the walls and timbers, while they are in a damp state, is the most certain means of causing the building to fall into a premature state of decay.

There is another cause that affects all wood most materially, which is the application of paint, tar, or pitch, before the wood has been thoroughly dried. The nature of these bodies prevents all evaporation, and confines the internal moisture, which is the cause of sudden decay. Mr. Bramley remarks, that both oak and fir posts were brought into a premature state of decay, by their having been painted prior to a due evaporation of their moisture.

On the other hand, the doors, pews, and carved work, of many old churches, have never been painted, and yet they are often found to be perfectly sound, after having existed above a century. In Chester, Exeter, and other old cities, where much timber was formerly used, even for the external parts of buildings, it appears to be sound and perfect, though black with age, and has never been painted.

Mr. Semple mentions an instance of some field-gates, made of home fir, part of which, being near the mansion, were painted, while the rest, being in distant parts of the grounds, were not painted. Those which were painted soon became quite rotten, but the others that were not painted continued firm.

Painted floor-cloths are very injurious to wooden floors, and soon produce rottenness in the floors that are covered with them; as the painted cloth prevents the access of atmospheric air, and retains whatever dampness the boards may absorb, and therefore soon causes decay. Carpets are not so injurious, but still assist in retarding free evaporation.

(TO BE CONTINUED.)

ENGLISH PATENTS.

To SAMUEL PARKER, *of Argyle Street, St. James's, in the County of Middlesex, Bronze and Iron founder, and* WILLIAM FRANCIS HAMILTON, *of Nelson Street, Long Lane, in the County of Surrey, Engineer, for their invention of a certain Alloy or Alloys of Metal.* Sealed 12th November, 1825.

In our present vol. page 32, we noticed the invention or discovery of a new alloy of Metal, which exactly resembles fine gold, and is denominated Or-molu, or Mosaic gold, for which the inventor obtained a patent as above. We had considered this metal to be only a superior quality of brass, presenting a fine gold colour, and it now turns out that our notions were right.

The patentees state in their specification that great care and experience are necessary to the perfecting of this alloy, as the same materials will not, under different circumstances, produce similar results. They make use of equal quantities of copper and zinc, melted at the lowest temperature that copper will fuse, and having stirred them together, so as to produce a perfect admixture of the metals, they then add a further quantity of zinc in small portions, until the alloy in the melting pot becomes of the colour required.

If the temperature of the copper is too great, a portion of the zinc will fly off in vapour, and the result will be, that alloy commonly called spelter, or hard solder; but if the operation is carried on at as low a temperature as possible, the alloy will first assume a yellow colour, as brass, and then by the addition of small portions of the zinc. the colour will change to a purple or violet hue, and ultimately become perfectly white, which is the appearance that the proper alloy should assume when in a fused state. This alloy may be cast into ingots, or in any forms required, and when cold will have the appearance of an alloy of fine gold and copper. But it is difficult to preserve its character when re-melted, as the zinc is very apt to waste by flying off in evaporation, by raising the temperature above that point at which copper begins to fuse.

The Patentees are aware that a variety of alloys of copper and zinc have been made, and that they cannot maintain the exclusive right of mixing alloys of those metals abstractedly; but having after great labour and observation discovered the precise proportions of the two metals, and the modes of treatment which will produce an alloy resembling fine gold, they claim the exclusive right of mixing an alloy of copper and zinc, consisting of from fifty-two to fifty-five parts zinc out of a hundred. [*London Journal of Science.*

Remarks by the Editor.

In vol. i, page 139, of this Journal, we published an account of a new alloy, called *Mosaic Gold.* The foregoing specification is the one to which allusion is there made, and we confess that we have felt some disappointment on reading it, as it appears scarcely probable, that a compound of copper and zinc, possessing all the properties there ascribed to Mosaic Gold, should have escaped the notice of founders, and other workmen, who have been in the habit of combining these two metals in every possible proportion, and employing them for a great variety of purposes. We, however, have determined to have the thing fairly tested by an intelligent brass-founder and metal-worker in this city, the result of which we hope to make known in our next number.

To Stephen Wilson, *of Streatham, in the County of Surry, Esq. in consequence of communications made to him by a certain Foreigner residing abroad, for a new manufacture of Stuffs, with Transparent and Coloured Figures, which he calls Diaphane Stuffs.* Sealed 25th November, 1824.

This invention is the production of a novel kind of stuff goods, by a peculiar process of manufacture, which is to be denominated *diaphane stuff.* The patentee states, that this new fabric consists of "a firm or band net work, figured on solid or perfect ground, exhibiting coloured patterns thereon." The method of making this particular kind of stuff can only be well understood by a practical weaver of figured goods.

The threads, or yarns, which are intended to constitute the warp or chain of the fabric, are to be wound with great care evenly upon the beam or roller, and when placed in a loom, are to be edged with cords, for the purpose of forming a strong selvage. They are then to be woven by the intervention of shoots of a coarse material, forming by that means an open fabric, merely for the purpose of giving stability to the warp threads, while the patterns or figures are painted or printed upon them; the coarse material thus shotten is intended to be removed, to give place to the weft-thread that shall be afterwards introduced, when the ultimate weaving is performed.

This fabric is now to be printed or painted in the ordinary manner, with such forms, characters, or devices, as are intended to constitute the pattern. It is then to be streamed, and otherwise operated upon, as is usually practised, for the purpose of fixing the colours, and then washed, in order to remove the gummy matters.

When the fabric has been thus treated, it is to be placed in the loom again, and some of the coarse shotten threads being removed at the commencement of the piece, the warp or chain threads are to be carefully passed through the spaces of the reed, and then secured, taking great care that the pattern, or design painted thereon, be not disturbed or distorted, the remainder of the coarse weft threads being drawn out in succession, as the work approaches them, that is, as the stuff becomes woven.

The process of weaving is now to go on as usual, by raising and depressing portions of the chain, or warp, and passing the weft or shoot through between, which is to be done in a loom furnished with harness; and having the pattern of the diaphanous or transparent parts read in, as in ordinary figure weaving; or, which is much to be preferred, in a loom of the kind called the *Jaquart*, which the present patentee introduced from France, and became proprietor of, in 1820.

To enter further into the detail and minutiæ of the process of weaving this particular kind of fabric, would be uninteresting, and, perhaps, unintelligible to many of our readers; it will, therefore, suffice to say, that by the above mode of proceeding, a fabric is produced, called diaphane stuff, having certain portions left so thin as to be transparent, upon which are painted or printed coloured figures, which as a whole constitutes a kind of fabric new in this country, the exclusive manufacture of which is claimed under this patent.—[*ib.*

To George Wycherley, *of Whitechurch, in the County of Salop, Saddler, for his new and Improved Method of making and constructing Saddles.* Enrolled June 1825.

The improvements, upon which this patent is founded, are arranged under three heads: the first is the introduction of an additional padding to the fore part of the saddle, for the purpose of fitting the back of the horse more perfectly than ordinary saddles packed in the common way. The object of this is to prevent the saddles from riding on to the neck of the horse, which it is said to effect in a satisfactory manner; as the straps and girth keep it steady, without the necessity of a crupper. The second head of the invention applies to side saddles, and consists in the introduction of a strap connected to the girth, which strap is passed over friction rollers, mounted in the saddle tree, and to the end of the strap the stirrup iron is attached, so that the foot of the rider pressing the stirrup, draws the strap, and with it the girth, and by those means keeps the saddle firm and tight to the back of the horse. The third head of the invention is the adaptation of the packing first described to the side saddle, for the purpose of fitting it more perfectly to the horse's back.

The mode of constructing these improved saddles may be very easily conceived. A padding, made in the usual way, is to be attached by stitching, to that part of the under side of the saddle tree, which is nearest to the shoulders and neck of the horse; it is to be made thick in front, and diminishing as it recedes, so as to fall into the ordinary figure of the under side, or packing of the saddle towards the back part.

As respects the side saddle, two angular straps are to be affixed to the saddle-tree on the off side, for the purpose of receiving the buckle and strap, to which the girth is attached, and another strap connected to the girth, is to proceed up between the opening of the angular straps, and to pass over one or more rollers placed in the under side of the saddle, and thence proceeding downwards on the near side of the horse, the stirrup iron is to be suspended to it, so that the pressure of the foot of the rider may act in giving additional tension to the girth.

The introduction of the packing before described, to the under part of the side saddle, is to be effected in the way already explained, and being intended for the same purpose, needs no further description. [*ib.*

To David Oliver Richardson, *Kerseymere and Cloth Printer, and* William Hirst, *Manufacturer, both of Leeds, in the County of York, for their Invention of certain Improvements in the Process of Printing or Dying Woolen and other Fabrics.* Enrolled January 1826.

This invention consists in covering parts of the surfaces of woolen fabrics, with a certain composition that will resist the chemical action of the coloured liquor, into which the fabric is to be immersed in the process of dying: in order that, when the cloth so covered is withdrawn from the dying vat, and the composition is removed from its surface, those parts which have been thus guarded, may have retained their original colour, and not have been in any degree affected by the dying liquor.

The composition is to be made by mixing about five stone of wheaten flour, with about four gallons of water; making a smooth paste, about the consistency of treacle. It is not to be boiled, we presume, as the specification is silent upon that subject. After this mixture has stood for three or four days, the yolks and whites of forty raw eggs are to be added, and the whole stirred well together. The composition is then ready for use; and is to be laid upon the fabric by means of a brush, when large portions of the surface are to be protected, or by printing blocks, when small parts of the surface are to be preserved from the ground colour in the form of a pattern. A small quantity of powdered glass, or shells, or fine sand, is then to be sifted over the composition, for the purpose of assisting to set and bind it firmly; this, however, may be dispensed with, if the composition is thick, and can be dried soon. The fabric being thus prepared, is then ready to be immersed in the dying vat, and treated as usual.

When the dying process has been performed, the fabric is to be withdrawn from the vat, and the composition being scraped off, or otherwise removed, presents those parts which were covered, perfectly free from the colour of which the other portions of the surface of the fabric have been dyed.

For the purpose of further illustration, the patentee describes the process of dying and figuring a lady's shawl in several colours. Suppose one side of the shawl is to be dyed of a plain blue, all over its surface, and the other side is to have a rose coloured ground, with a white border, to be afterwards printed with a chintz, or other pattern. The shawl being stretched upon a square frame, that side which is to be blue, and that part of the other side intended for the border, is to be covered with the composition as a guard, leaving only that part exposed, which is designed to be dyed a rose colour; the frame, with the shawl, is then immersed in the dying vat, and remains there until it has imbibed its tint.

The shawl being now withdrawn from the dye, that side which is intended to be blue, is to be cleared from the composition, and the other side covered completely. It is then immersed in the blue dye, and after that operation has been performed, the whole of the composition is to be removed, and the shawl will appear blue entirely on one side, and rose coloured, with a white border, on the other; which, being afterwards printed in the ordinary way, with a chintz or other suitable pattern, finishes the colouring of the shawl.

The patentees state, that their claim of invention, is the "covering of parts of woolen, or worsted fabrics, which are to be dyed, or dyed and printed, with a composition which resists the action of the dye, when the fabric is in the dye kettle." How this can be exclusively maintained, we do not see, as table covers, and a variety of other articles, which have been coated and dyed in this manner, for a considerable length of time, having purple or green grounds, with yellow or white borders and corners. The patentees also claim the application of "the particular composition herein before described, to that particular purpose." This particular composition, if it has not been so used before, they have a right to, but certainly not to claim the whole, in the broad way in which they have stated it. [*ib.*

To JOHN PHILLIPS BEAVAN, *of Clifford Street, in the County of Middlesex, Gentleman, in consequence of Communications made to him by a certain Foreigner residing abroad, for an Invention of a Cement for Building, and other purposes.* Enrolled April 1826.

This invention is called Vitruvian cement, and consists of a composition of marble, flint, chalk. lime, and water, which, when dry, is capable of being brought to a high state of polish.

The proportions are, one part of pulverized marble, one part of pulverized flint, and one part of chalk, mixed together, and sifted through a very fine sieve; to this is to be added one other part of lime, which has been slacked at least three months. To this is to be added a sufficient quantity of water, to make the whole into a thin paste, and in that state it is to be spread as thinly as possible over a coarse ground, and brought to a smooth surface by the trowel. This cement, when dry, may be polished with pulverized Venetian talc, until the surface has become perfectly smooth and shining.

In order to apply this Vitruvian cement to buildings, it is necessary that the parts to be covered should be first prepared with a rough ground, or under coat, which may be done with the following materials. Take equal parts of the coarsest river sand, and the sand which is pulverized from mill-stones; mix them together, and add a third part of lime, which has been slacked for about three months; to these put as much water as will bring the composition into a paste; and when it is about to be used, add a fifth of very fine sifted lime, and apply it as common plaster.

If the above Vitruvian cement is required to imitate the appearance of marble, that may be done by painting the veins like marble upon its surface, after the cement has been brought to a smooth surface by the trowel; and as soon as the paint has become dry, the polishing process may be performed with the pulverized talc, as above described, when the work may be considered to be finished.

In order to increase the lustre of the polish, the patentee proposes to employ a sort of varnish, to be made by mixing two pints of water with four ounces of white soap, eight ounces of virgin wax, and eight ounces of nitre, which are to be boiled together, till the substances are quite dissolved. When the cement is perfectly dry, this varnish is to be sprinkled over the surface, and when uniformly spread, is to be rubbed well with a linen cloth, until the lustre is sufficiently brought up. It is, however, to be observed, that this varnish is not claimed by the patentee; but is merely mentioned as a useful addition to improve the lustre and appearance of the cement, when a high polish is required, as in imitating marbles. [*ib.*

ANCIENT VASES.

(Continued from page 114.)

We shall place in the first class those vases in which the colour of the clay is natural, without glaze or other coating, or painting. Of this kind are some vases which were dug up at Cumæ, as well as near S. Agatha Sothorum, along with others of a black colour.

In the second class, we shall place those in which the natural colour of the clay is somewhat heightened by their having a very thin glaze or coating.

To the third class, belong those vases which have been manufactured of clay intermixed with black matter. These vases are found, either simple, that is, without ornaments and paintings; or decorated with ornaments, either impressed or in relief; or they are painted with a white or yellowish colour. Of this description are many of the vases dug up, not only in Lower Italy, but also in the districts of ancient Etruria.

To the fourth class belong those vases whose clay is evidently covered over with a black glaze or coating. Like those of the third class, they are either simple, or with ornaments, either impressed, or painted with a white, yellowish, or red covering.

The fifth class may contain those vases, in which, upon a basis of clay, either of the natural colour, or with a somewhat brighter glaze, there are ornaments or painted figures of a black colour, sometimes with impressed lines. These vases, which have been dug up in various places, although they commonly go by the name of Sicilian, are either simply painted with black, or ornamented with figures, in which the red and white colours are covered over with black: of which kind some exquisite vases have been found, as for example, in the vicinity of Pæstum.

To the sixth class we shall refer those painted vases, the most common of all, which have figures and ornaments either of the natural colour of clay or somewhat heightened, the general ground, however, and some lines, being black; some of them are of more simple construction, others are ornamented with white, red, yellowish, or dusky colours.

The seventh class includes those vases of rarer occurrence, in which the ground is black, and the figures, which are red, are laid upon a white colour covering the black, the lines being impressed so as to penetrate to the black ground.

The eighth class we shall appropriate to those very rare vases, commonly, but falsely, called Egyptian, in which the ground is yellowish, and the paintings of a coffee-colour, which, however, do not cover the ground perfectly, there being sometimes a covering of white and red colours. These vases, found in Lower Italy, correspond, in so far as regards the colour of the clay and paintings, with others discovered in Greece, one of which, that had been dug up at Athens, is preserved in the Museum of our University, having been presented to it by the celebrated English traveller Hawkins.

SECT. II.—*Of the Composition of Vases, commonly called Etruscan, in detail.*

1. *Qualities of the Materials.*—The vases described in the preceding section are formed of a fine clay, which is impregnated with iron, and consequently reddens more or less by the action of fire, but whose qualities differ in the different varieties of those vases.

The finer substance of the better sort of painted vases, is that of which the vases with a simple black coating, or those entirely black, are composed, the specific gravity being in proportion to the degree of fineness. The whole of these vases are indeed very light, but more especially the finest kinds; and in them also there is considerable difference with regard to this quality. The vases of Nola seem to exceed the rest in lightness; and by this general quality, in fact, the truly antique vases may readily be distinguished from all imitations of them.

Certain differences are also to be observed in the colour of the materials. In the more valuable kinds, it sometimes approaches to brick-red, but its most common tint is yellowish-red. In the coarser kinds, the colour of the clay is usually paler than in those of finer texture.

I cannot, however, agree with those who are of opinion that a red pigment has been added, in order to increase the intensity of the colour; for this reason, that the internal colour of the mass agrees perfectly with that usually observed in ferruginous clay that has undergone the process of roasting, and the fractured surface exhibits no inequalities in regard to colour.

In the finer vases there are no heterogeneous parts, nor is any admixture, as of sand, for example, observable. They have been manufactured either of clay in the natural state, if it had been pure, or carefully prepared by washing.

The colour of those vases which are decidedly black, has, without doubt, been produced by the admixture of some black substance, and not by the natural colour of the clay, or by the action of vapours. Upon accurate examination, yellowish particles, together with small black shining grains, are observed in the black mass; from which it may be supposed that the mixture has not always been perfectly equal. The celebrated Brochi detected minute scales of mica in the substance of the black vases found in the ancient sepulchres of Etruria.

According to the chemical analysis of Vauquelin, a hundred parts of the mass of those vases usually called Etruscan, contain—Silica, 53; Alumina, 15; Lime, 8; Oxide of Iron, 24. This quantity of iron, it may be remarked, is singular, and is probably not so great in the whole of these vases.

2. *Conformation of the Vases.*—The vases commonly called Etruscan, seem, without exception, to have been moulded on the wheel; the invention of which is, without doubt, of the greatest antiquity, as has lately been ingeniously demonstrated by the investigations of my friend Ritter. That the whole of these vases were, in reality, formed by the wheel, appears to be proved by the following considerations:—1. Because no other forms are seen in them, but such as can be produced by the wheel; no vases of such a form as to present an oval in their transverse section, or exhibiting other curves deviating from the circle, which could only be produced by the aid of moulds or other means. 2. Because traces of the wheel often occur, especially on the inner surface of the vases, as well as beneath, on the base, and in other parts not so carefully smoothed as the rest. 3. Because, on the other hand, no marks are ever observed, from which it might be inferred, that these vases have been fabricated by a more complex and artificial method; for example, no seams, which it is difficult to avoid when moulds are used.

Vases are more or less accurately shaped. The finest kinds, turned with the greatest care, and ornamented with paintings, are exact in their dimensions, with thin walls, and a smooth surface, having no marks of the wheel; from which it may be conjectured, that, after the vases had been formed in the wheel, some processes had been adopted for smoothing the surface, perhaps not unlike those which are applied by our own potters to the same purpose.

It is unnecessary for us to enter in this place upon a full account of the particular forms given to these vases, as they have been described and delineated with sufficient accuracy, in many works on the subject. The variety is not less to be admired than the elegance of the forms, although in this respect also some differences are observed between the more exquisite vases and those of inferior quality, between the Grecian vases and those of Etruscan origin.

According to their forms, four principal classes of vases may be distinguished. 1. *Vases properly so called.* They differ greatly in size and proportion of parts. The mouth is either much greater than the diameter of the body, or is of the same size, or smaller. In this manner, it is often furnished either with a lid, or with a cup or funnel-shaped process. The body is usually ovate, or approaching to this form, or bell-shaped, or calyciform: of these principal forms there are, however, innumerable varieties. Vases occur either simple, or furnished with handles, of which there are two, or three, or sometimes four, and these are affixed to the lip, or body, or lower part of the vase.—2. Vases, commonly called *Præfericula* by the ancients, which are usually furnished with a single handle.—3. *Vasa unguentaria*, with a long narrow neck.—4. *Patæra* or *Goblets*, which have commonly two handles.

There are certain parts in vases which have not been formed along with the body upon the wheel, but have been made separately, and afterwards joined to the body. Of this kind are, 1. The handles, with which vases and goblets are frequently furnished; 2. A prismatic base, instead of the common round one. This, however, is of a very rare occurrence in vases: I have seen an instance of it in a vase of Grecian origin, in the Royal Collection at Naples. In these parts I have found no indication of their having been formed in moulds: they seem, without exception, to have been made by the hand and instruments.

3. *Composition of the Plastic Ornaments of Vases.*—The plastic ornaments which we find upon vases, have been made by the wheel, or in some other way. Of the former kind, are all those simple ornaments, whether raised or impressed, with circular outlines, which surround certain parts of vases, as, for example, the upper margin, or ball of the lid, which have, without doubt, been formed in a way similar to that employed by our potters, by means of certain instruments.

To the plastic ornaments not prepared upon the wheel, belongs the raised work, which is sometimes, though rarely, seen in the principal part of vases, and more commonly on the handles. Some black Etruscan vases, preserved in the public collection at Florence, are furnished with raised ornaments on the principal part, or body. Two large vases, of elegant form, are encircled by vine tendrils. Others of them have raised figures of animals. Some, again, with a narrow neck, are terminated by vine-leaves. In others, there are rounded raised lines, which rise from the bottom to the bulging part of the body, or descend to it from the neck. The handles are ornamented in this way, not only in the black Etruscan vases, but also in the painted ones of Grecian origin. They are often terminated by heads, or entire figures, beautifully imitated, or are made to assume the form of twisted serpents, or are marked with depressed, or raised, lines.

It is a question, whether these ornaments have been made by means of moulds, or simply by the hand. From the inquiries which I have made in regard to this matter, I am inclined to think, that all those plastic ornaments have been formed with the hand, by means of simple instruments, and not by moulds, as is now practised. 1. Because no marks of moulds, no seams, for example, are to be observed; 2. Because small differences are commonly found in ornaments of the same kind: the heads or figures of handles, for example, in the same vase, differ a little; the excavated or rounded lines, in the same part, have not always the same dimensions. In the latter pottery-work of Roman origin, on the contrary, the use of moulds may commonly be observed.

Impressed ornaments also sometimes occur, especially in the black Etruscan vases. They consist either of impressed lines or dots. Ornaments of this description, may easily be formed by instruments similar to those which are used in making seals. The differences, however, often conspicuous in those ornaments in the same vase, appear to me to prove, that they have not been made in this way, but by means of a hard stilus. In one part of the ornaments, for example, the number of dots is greater than in another, or the dots in one row are a little nearer than in another. I have remarked the same of the letters which are sometimes seen on Grecian vases. Upon examining them, it clearly appears that they have not been inscribed by instruments similar to those used in cutting our seals, but also by means of the style. Among the Romans, in later times, stamps, or seals, with elevated letters, as on coins, were very frequently impressed upon earthen-ware, such as bricks, vases, and lamps.

4. *Baking of Vases.*—The whole of the vases of which we speak, are baked, but in different degrees, never more, and generally less, than our best pottery-ware. According to the opinion of the celebrated Chaptal, which agrees with the above, the heat applied for baking may be estimated at seven or eight degrees of Wedgwood's pyrometer. We never find the argillaceous mass converted into glass, nor the smallest indication of fusion; there is never, therefore, any resemblance to the stone-ware of the present day.

The finer painted vases are universally more baked than the coarser, and of the latter, those which are entirely black are the least baked; the different degrees of baking being estimated by the difference in hardness, sound, and porosity; the latter of which is known by the different degrees in which the mass absorbs water.

It is the general opinion of all who have written on the composition of antique vases, such as Grivaud, Rossi, Hirt, and Jorio, that the painted vases of antiquity have been manufactured in the same manner as our finer modern pottery-ware; that after being first baked, the paintings have been applied, and the whole submitted again to a greater heat.

From the vases themselves, we cannot now learn whether they have been once or twice baked; but from any investigations, with regard to the nature and composition of the paintings, it seems to me more probable that the whole have been once strongly baked, by which they have acquired the necessary degree of hardness and fineness, and at the same time preserved their porosity, and that the colours have afterwards been spread over them by a lesser heating.

5. *Composition of the Paintings.*—In a disquisition regarding the mode in which the colours may have been applied, the following subjects demand investigation:—1. The nature of the pigments; 2. The mechanical mode in which they are laid on; 3. The operations used after the pigments have been applied.

None of the vases are overlaid with the vitreous substance which we call *glaze*, either joined with the colours, or separated from them. The vases which are entirely black, have no coating different from the mass, and the lustre of the surface is produced by the substance of the vase itself, as we shall presently show. Other vases are furnished with a simple black coating, which, however, has no resemblance to the glaze of our earthen-ware, but is more like varnish. Painted vases either show in certain parts a surface of baked clay, or there is a very thin, pellucid, varnish-like coating of clay, by which the colour of the clay is heightened a little, so as to have a dusky or dark red appearance.

A black colour, corresponding with the black coating of some kinds, is very common in the paintings of vases. Other colours appear much more rarely, and less extensively applied.

This black colour, therefore, we shall examine first, as being, of all things connected with vases, in so far as regards art, the most worthy of accurate investigation. It is usually of a pitchy tint, sometimes passing into brown, or, when thinly applied, appearing even of a coffee colour. It seldom passes into livid, or green, which I have observed, however, in some vases of the Florentine and Roman collections. The lustre of the colour is of various degrees of brightness, sometimes it is scarcely apparent, and is always more like that of varnish than of glass. In other respects, also, the black coating is always dissimilar to glass: when minutely examined, however, with the microscope, it has the appearance of being fused. It is of different degrees of thickness, seldom so great as to be sensible to the touch. The black coating is firmly adherent to the surface, although it does not penetrate into the clay, nor is conjoined with its particles by fusion. Its adhesion is firmer in the finer vases, than in those of coarser quality. None of those cracks or fissures are seen in it, which frequently occur in the glaze of earthen-ware. It is not dissolved by acids, or any other fluid. I have exposed fragments of painted vases for a long time to the action of nitric and muriatic acids, but never observed any effect produced upon them. It even sustains a considerable heat without injury, and it may be exposed for a long time to the blow-pipe, without undergoing any distinct change. When the condensed flame was directed toward part of the paintings for some time, I have observed that the nearest parts of the clay were covered over with a black exhalation; but I cannot say whether this exhalation be produced by a sublimation of the pigments. The black varnish is sometimes covered over by a white exhalation, when burnt; the production of which may perhaps be explained, from the decomposition of its substance. More accurate investigation, however, has shown me, that the white colour arises from the burning of the calcareous particles intimately conjoined with the surface of the vases, and cannot be ascribed to the ashes of the varnish.

(TO BE CONTINUED.)

On the construction of Fire Places. By Dr. Arnott.

During my attendance lately in some cases of pulmonary disease, while considering how best to attain the important objects of uniformity of temperature, and the prevention of draughts or currents of air in the apartments to which the patients chiefly confined themselves, a simple means occurred to me, which, on trial, perfectly succeeded. It is an addition easily made to any fire-place; and as its uses are important to the health and comfort of all the inhabitants of cold climates, I am happy to suggest it to the public.

It is simply a glazed metal frame-work, or window, placed before the fire, and coming in contact with the chimney-piece and hearth all round, so as perfectly to cut off communication between the room and the fire-place, and the fire is fed with air brought by a tube from without.

Completely to understand the effect of it, it may be remarked, that of the heat produced by the combustion of fuel in a common fire-place, a part radiates into the room as the light does, and the remainder ascends the chimney with the smoke. That which finds its way into the room, contrary to common apprehension, is probably not more than a fourth part of the whole heat produced; but even less than this would be sufficient to preserve in the room the desired temperature, could it be all retained. The great current of air, however, in the chimney, carries this heat again quickly with it, (for it is the warm air of the room passing away,) and a chimney of the ordinary proportion, and with the ordinary velocity of the smoke, will allow the whole air of the apartment to pass out by it in less than half an hour.

The glazed frame, then, described above, will prevent, it is evident, the heat when once received into the room from again escaping from it, as it now does, with the air ascending in the chimney; and although the glass is some obstacle to the radiation of the heat from the fire in the first instance, the disadvantage is much more than compensated by its retaining agency afterwards.

One of our rooms as now constructed and heated, may be compared to a vessel of water of similar shape, with a hole near its bottom, through which the water is constantly running off, while an attempt is making, at the same time, to warm its contents by heat radiating inwards, from the hole and around it. The hottest water would always get out first, being nearest to the opening from whence the heat came; and to keep the vessel full, this would be replaced by fresh cold water entering by one or more openings in the circumference.

It would require a powerful heat indeed, to raise much the temperature of such a vessel; and it is evident, that no degree of heat so admitted could warm the contents uniformly.

It may be supposed that I have underrated the proportion of caloric which radiates from a fire into the room, compared with that which ascends into the chimney, in calling the former only a fourth part of the whole produced; but the following considerations, without new experiment, may probably be accounted decisive of the question. Mr. Leslie, in his experiments on heat, found that a metallic vessel of water, of medium temperature, suspended in the air, lost about half its caloric by radiation, and half by contact with the air. At a higher temperature, however, on account of the increased velocity of the air, caused by its greater expansion, or in an artificial current of air, without higher temperature, it lost much more by contact than by radiation. Now, in a fire are found the two circumstances of extreme heat and great velocity, and to these is added a third, of much greater importance than either, viz: the surface of contact being exceedingly increased by the air passing between the pieces of coal, while the surface of radiation, viz: the external surface, remains the same. It is a thing not sufficiently adverted to in the management of our fires, that the heat given into the room, is proportioned rather to the extent of burning surface presented towards the room, than to the depth of the fire, the intensity of the heat backwards, and the quantity of the fuel consumed. I have been trying experiments, with a view to ascertain the proportions exactly; of which, however, I have not as yet had time to prepare an account for publication; but as the general result, I may state, that a tile or sheet of iron, laid on the back part of the fire, so as to cover it closely, and to prevent combustion except in front, rather increases than diminishes the radiation of heat towards the apartment, and much less fuel is consumed.

In constructing the glass frame proposed, a part must be made to open, to allow the putting on of coal, and stirring of the fire. The air to feed the fire may come from an opening in the external wall, by a tube concealed behind the wainscot. In the case where it was first tried, a useless chimney happened to pass by the side of the fire-place, and a brick taken from between them, gave admittance to the air. In whatever way the object be accomplished, we should have it in our power to admit more or less air, so as to regulate the combustion at will, as in the common furnace. The room may be ventilated by a small opening near the ceiling, either into the chimney or into the stair-case, to be made to open, and close, to the degree required. The heated air tubes now commonly connected with fire-places, are peculiarly adapted to this plan, and with it produce the greatest possible saving of fuel; and the method of supplying coal to the fire from below it, or in any other way that secures the combustion of the inflammable gases contained in the coal, which I hope may soon become general, has the same utility here as in other cases.

The advantages of the plan may be shortly enumerated as follows:

1. The nearly perfect uniformity of temperature in the air through-

out the room, renders it a matter of indifference in what part the company sit.

2. The total prevention of draughts, or currents of air, which are inevitable in our rooms, as now warmed, because the fire must be supplied with air from the doors or windows. It is almost needless to mention, that a great portion of the winter diseases of this climate, are occasioned by these currents acting partially on our heated bodies.

3. The saving of fuel. Less than half the usual quantity will generally be found to keep the apartment in the most comfortable state.

4. The raising the temperature of the house generally; for were all the chimneys thus closed with respect to the apartments, although fires were lighted but in a few, any degree of heat once generated in the house would be long retained.

5. It completely prevents smoke, or dust, a circumstance which alone renders it extremely valuable in many cases; and with it there is no danger of fire.

In these particulars are comprehended all the advantages of the close stoves of continental Europe, so superior to ours in economy, and in the degree and uniformity of the temperature produced, with what many will call a very great additional one, that of seeing the fire; and it avoids their disadvantage, of giving a burnt or sulphury odour to the air of the apartment. It should not be forgotten, that at a very moderate expense, the change described may be made on all our common fire-places. [*Journal of Sciences and the Arts.*

FOR THE FRANKLIN JOURNAL.

MECHANICAL JURISPRUDENCE.—No. IX.

BY PETER A. BROWNE, ESQ.

On the law of Patents for new and useful Inventions.

Having in the last number of these essays, treated of the *personal* qualifications of the patentee, the next points to be considered are the qualifications of the *invention*, or *discovery*.

They are four in number. 1. That of being the patentee's *own* invention or discovery.—2. That of being *new*.—3. That of being *useful*.—4. In England, that of being a *manufacture:* in the United States, that of being an *art*, *machine*, *manufacture*, or *composition* of *matter:* or, in both countries, that of being an *addition* or *improvement*.

It is a requisite of every patent issued under the authority of the United States, that the thing patented, should be the patentee's OWN *invention*, or *discovery*.

The Constitution of the United States, in the 8th section of the 1st article, declares, " that Congress shall have power to promote the progress of science, and useful arts, by *securing*, for limited times, to *authors* and *inventors*, the exclusive right to *their* respective writings and discoveries." It is to *secure*, not to *grant*, the right. A *grant* implies a property in the thing granted in the grantor, or person making the grant: but the framers of the Constitution never meant to invest Congress with the private property which every citizen has in his own inventions and discoveries. The right, (as Judge Washington, in a case which will be hereafter quoted, justly observes,) is in the inventor, before the patent is granted. To *secure*, means only to protect, and insure, a pre-existing right. This, Congress might well do, by virtue of its *superintending power over* the property of the citizens. So, to *grant*, pre-supposes a legal right to convey the thing granted, to the grantee. But if the right belonged to the *community at large*, Congress could not grant it to an *individual;* for, as before shown, that would be to create an odious monopoly, inconsistent with the fundamental principles of our government. A careful examination of the acts of Congress, will satisfy us, that the constitutional provision has, in this particular, been *strictly* pursued.

The 1st section of the act of Congress, of the 21st February, 1793, enacts, that "when any person, or persons, being a citizen, or citizens of the United States, shall allege, that he or they have *invented* any new and useful art, machine, manufacture, or composition of matter," &c.

The allegation must be, that the applicant has *invented* the thing claimed to be patented.

So, in the 3d section, "Every *inventor*, before he can receive a patent, shall swear, or affirm, that he does verily believe, that he is the *true inventor*, or *discoverer*, of the art, machine, or improvement, for which he solicits a patent," &c.

The 6th section contains a proviso, that if the defendant, in any suit for invading a patent right, can prove that the patentee was not the *original discoverer*, judgment shall be rendered in his favour, and the patent shall be declared void. And, lastly, in the 10th section, "the District Court of the United States, where the patentee or his representatives reside, may, if it appears that the patentee was not the *true inventor*, or *discoverer*, enter judgment to repeal the patent."

It must be obvious, from the preceding quotations and remarks, that, in the United States, no patent for any discovery or invention, can be of any validity, unless the patentee is the *true* and *original inventor*, or *discoverer*.

Any attempt on behalf of any other person, to obtain a patent, is useless; it is worse than useless, it is *criminal*, if the applicant takes the oath required by the 3d section of the act of Congress.

Whether, in England, any one, who is not the inventor, can take out a valid patent, must depend upon the statute of 21 James the first, and a sound construction thereof. The statute enacts, "that all monopolies, and all commissions, grants, licenses, charters, and letters patent, to any person or persons, bodies politic or corporate, whatsoever, of or for the sole buying, selling, making, or working, or using, any thing within this realm, or Wales, or of any other monopolies, and all proclamations, inhibitions, restraints, warrants of assistance, and all other matters, whatsoever, any way tending to the instituting, strengthening, furthering, or countenancing the same, or any of them, are altogether contrary to the laws of the realm, and so are, and shall be *utterly void and of none effect*, and in no wise to be put in execution."

The 6th section of the statute then provides, that "no declaration in the statute mentioned, shall extend to any letters patent, and grants of privileges, for fourteen years, or under, of the sole working or making of any manner of new manufactures, within this realm, *to the* TRUE *and* FIRST INVENTOR, *and* INVENTORS, of such manufactures, which others, at the time of making such grant, shall not use; so, also, they be not contrary to the law, nor mischievous to the state, by raising the prices of commodities, nor generally inconvenient; the said fourteen years to be accounted from the date of the first letters patent, or grant of such privileges, but that the same should be of such force, as they should be if the said act had never been made, and of none other."

The rules for the construction of statutes, require, that *technical terms*, or terms of art, shall be taken according to their acceptance by the learned in such art; and that words *not technical*, shall be interpreted after their most usual and common acceptation. I believe it will be immaterial, which of these rules shall be applied, in the interpretation of the word "*inventor*," in the above proviso: for it has been used in the arts precisely in the same sense as in common parlance, namely, to describe one who *devises*, or *contrives*, or *discovers* something. It corresponds with the French word "*inventeur*," which is defined to be "*celui qui trouve quelque chose de nouveau, par la force de son imagination*.*

That this was the sense in which the word inventor was understood, at the time of the passing of the act of Parliament, will appear from the circumstances, that Sir Edward Coke, who was in Parliament at the time this act passed, who was chairman of the committee to which the bill was referred, and who, of course, was fully competent to explain its meaning and intent, has given it a construction in the 3d volume of his Institutes. In page 184, he says, "It must be granted to the *first* and *true inventor*." It is matter of surprise, that the plain and intelligible words of the statute should ever have been construed to entitle any one but the *inventor* to take a patent: but so it is.

In the 4th year of James the second, the patentee of a horizontal mill, instituted a suit, in the King's Bench, to recover damages against one, who, it was alleged, had invaded the patent; and, upon the trial of that cause, the judges, Holt and Pollexfen, are represented as having said, "that if the invention be new in England, a patent may be granted, though the thing was practised beyond sea before; for the statute speaks of new manufactures within the realm; so that if they be new *here*, it is within the statute; for the act intended to encourage new devices, useful to the kingdom; and *whether learned by travel, or study, is the same thing*." 2 Salkeld's Reports, 447. Edgeberry *v.* Stevens.

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* He who finds out something new, by the powers of his own conception.

Upon the authority of this case, Hawkins, in his Pleas of the Crown, b. 1. c. 79. s. 23. lays down the law to be, that a patent, granted for an *old invention*, IMPORTED into England from abroad, is good, provided it be entirely new in the kingdom. And C. J. Eyre, in delivering his opinion in the case of Boulton *v.* Hull, 2 Henry Blackstone's Reports, 491, says, that "the above case establishes, that the *first introducer* of an invention practised beyond sea, shall be deemed the *first inventor*." And Mr. John Davis, of the Rolls Chapel office, who, in 1816, made a collection of the most important English cases respecting patents of invention, to which are added some practical observations, remarks, that "the above decision is, at this day, acted upon to a great extent, as many patents are granted to persons resident in England, for inventions *communicated* to them from abroad, it being only considered necessary, under the words of the statute, that they should be new within this realm."

It may perhaps be considered presumptuous in me to call in question a position *apparently* so well supported by authority, and so long sanctioned by practice. But when we are in search of truth, we must be careful not to sacrifice *principle*, at the shrine of *great names*. I shall therefore, with due deference, proceed to inquire into the propriety of the rule.

I propose to show, *that the position is directly at variance with the plain words of the statute*. The statute confines the patent to the *true* and *first inventor*. The position is that it shall be granted to the *importer* or *intròducer*.

The case relied on does not support the position. It would seem from the report, that the decision did not at all turn upon the words "true and first inventor," but upon the words of the statute, "new manufactures within this realm;" for the case states, that if the invention be new in England, a patent may be granted, though the thing was before practised beyond sea. This is the decision. It is in a subsequent part of the case, which professes to give, not the decision, but, the reason for the decision, that the words are to be found that are relied on. The decision may be very sound, and the reason unsound.

The report is not entirely to be depended on.

1st. Because it does not appear to have been heard, or taken down, by the reporter in whose book it is found. William Salkeld's 2d volume of Reports, professes to contain cases decided, from the 1st year of William and Mary, to the 10th year of Anne. This case occurred in the 4th year of James II. The cases are arranged, according to the subject, in alphabetical order, and this case is the only one on "monopoly."

2nd. The report, itself, is not sufficiently full, and is confused. It ought to have stated, whether the plaintiff was, or was not, the *inventor;* but this is no where stated in the case. And it connects together, in a confused manner, two questions, in their nature entirely distinct, viz. the question, *who was the inventor*, and the question, *whether the invention was new.*

3d. It is differently reported in another book, in Comberbach's

Reports, page 84. It appears from that report of the case, that the *plaintiff was the inventor;* and the question agitated, was, whether he, *being the inventor*, could have a valid patent for what was new in the realm, but was used beyond sea; and it was decided, that he could: but the expression imputed to the judges, in the report in Salkeld, viz. "that whether learned by *travel*, or study, is the same thing," is no where to be found in Comberbach.

The material parts of the case, as reported by Comberbach, are as follows: "The plaintiff declares, *that he was the first inventor* of the horizontal mill, for which he had letters patent for fourteen years; and that, notwithstanding which, the defendant made another mill, like, &c. and damage, &c. Verdict for the plaintiff. Objection, notwithstanding it might be used beyond sea? Answer, admitting that, yet it shall be good, and within the statute, for that speaks only of new manufactures within this realm, which Halloway agreed."

What does this case decide? That the *first inventor* may have a patent for what is new in the kingdom, though it was previously used beyond sea; but it does not decide, that the *introducer*, or *importer*, shall enjoy any such privilege.

4th. After a careful search, I have not been able to find any subsequent English *adjudication*, establishing this position. C. J. Eyre's assertion is only an *obiter dictum*, and, I think, a hasty one.

5th. *So far as the point has been judicially noticed, in England, it has been negatived.*

The King *v.* Arkwright. June 25, 1785.

This was a scire facias, out of Chancery, to repeal the patent of Mr. Richard Arkwright, for an invention of certain machines for preparing silk, cotton, flax, and wool, for spinning.

One of the allegations in the scire facias was, that the same was not invented and found out by the said Richard.

Mr. Bearcroft, on behalf of the prosecution, said, But if this was a new invention, it was not Mr. Arkwright's; it was the invention of a very poor man, then alive, who would be produced. He communicated it, as a great secret, to another man, who sold it to Mr. Arkwright; therefore, it was not Mr. Arkwright's invention.

Mr. Adair, for the defendant, said, the originality of the invention had never before been disputed. He stated one of the questions to be, "whether Mr. Arkwright was, or was not, the *inventor*." He further admitted, that if *any one* of the issues was found against Mr. Arkwright, it was the same as if the whole were. Mr. Bearcroft, in reply, contended, that three propositions were made out, every one of which destroyed the validity of the patent; one of which was, that Mr. Arkwright *was not the inventor.*

Witnesses were examined on both sides, the object of whose testimony was to ascertain, whether, in point of fact, Mr. Arkwright *was the inventor.*

Mr. Justice Buller stated, that the case was of great importance. That one of the questions was, whether the machinery was *invented* by the *defendant*. The Judge then stated the evidence on this head, on the one side and the other, and concluded as follows: "Gentlemen, thus the case stands, as to the several component parts of this machine; and if upon them you are satisfied, none of them were inventions unknown at the time this patent was granted, or *that they were not invented* by the defendant, upon either of these points, the prosecutor is entitled to your verdict. If upon *any* point, you are of opinion with the prosecutor, you will find a verdict for him. If upon *all* the points, you are of opinion for the defendant, you will find a verdict for him."

The verdict was against the defendant; a new trial was moved for, but no allegation was made of a misdirection in point of law.

In 1789, Hayne and another, pretending to derive a right under a patent of one Tayler, assigned to Maltby part of that right on certain terms. An action was brought upon the article of assignment, and one defence set up was, *that the invention was not discovered by Tayler, the patentee.* It was not pretended by the counsel for the plaintiff, that Tayler's patent was valid; but they relied upon the argument, that the defendant, by his covenant, was estopped from the allegation, that it was void. But judgment was given for the defendant. Ashhurst, J. says, "The plaintiffs use this patent as a fraud on all mankind; and they state it to be an *invention of the patentee*, when, in truth, it was *no* invention of his. The only right conferred on the defendant by this agreement, was that of using this machine, which was no more than that which he, in common with every other subject, has, without any grant from the plaintiffs." 3 Term Reports, 438. Hayne *v.* Maltby.

Tenant's case, tried before Lord Ellenborough, in 1802, was this: Mr. Tenant brought his action for an infringement of his patent for a bleaching liquor; several witnesses were called in support of the patent, who proved the great utility of the invention, and the general ignorance of the bleachers, with respect to such bleaching liquor, until after the date of Mr. Tenant's patent. On the other side, a chemist deposed, that he had suggested to Mr. Tenant, that he would probably attain his end in bleaching, by keeping the lime-water constantly agitated. Mr. Tenant afterwards informed the witness, that this method had succeeded. The conversations took place in 1796, and Mr. Tenant's patent was taken out in 1798. Lord Ellenborough declared this to be a scandalous patent, equally unfounded in law and justice. The plaintiff was non-suited on two grounds, one of which was, that a chemist had suggested to Mr. Tenant the agitation of the lime-water, which was indispensable in the process, and, therefore, *that it was not the invention of the patentee.*

To this may be added, that in all the best English precedents of declarations for infringing a patent right, the declaration states, that the plaintiff *is the inventor.* See 2 Chitty's Pleading, 320*. "For that whereas the said A. B., before and at the time of making of the letters patent, and of the committing of the grievances by the said E. F., as herein before mentioned, *was the true and first inventor* of a certain," &c.

These are the reasons, and authorities, which have induced me to *doubt* the rule, as laid down by Hawkins, and C. J. Eyre, that the *importer*, or *introducer*, can obtain a valid patent, and to suspect, that the practice mentioned by Mr. Davis, for persons in England to take out patents for inventions *communicated from abroad*, will not stand the test of judicial investigation. Believing this to be the law, and knowing that the expenses of taking out a patent, in England, are very considerable, I would not encourage any American to apply for a patent there, *unless he is the* INVENTOR.

On polishing Wood, Ivory, Horn, Tortoise-shell, &c. By the Editor.

An article upon this subject, furnished by those excellent workmen, Messrs. HOLTZAPFEL and DYERLEIN of London, appeared in the 2nd volume of the Technical Repository; some of the information contained in that paper, will be found among the following observations, together with some that is original, and, as we believe, better than the methods there described. Where we have borrowed, the inverted commas will mark the fact.

" *Directions for polishing in the Lathe.*

" *Good work* does not require much polishing, for the beauty of it depends more on being executed with tools properly ground, set, and in good order: the work performed by such tools will have its surface much smoother, its mouldings and edges much better finished, and the whole nearly polished; requiring, of course, much less subsequent polishing, than work turned with blunt tools. (This is often the case in that done by amateurs and workmen who have not proper conveniences for grinding and setting their tools.)

" One of the most necessary things in polishing, is cleanliness: therefore, previous to beginning, it is as well to clear the turning-lathe, or work-bench, of all shavings, dust, &c. as also to examine all the powders, lackers, linen, flannel, brushes, &c. which may be required; to see that they are free from dust, grit, or any foreign matter. For further security, the polishing powders used, are sometimes tied up in a piece of linen, and shaken as through a sieve, so that none but the finest particles can pass.

" Although, throughout the following methods, certain polishing powders are recommended, for particular kinds of work, it must be understood, that there are others, applicable to the same purposes, the selection from which, remains with the operator; only observing this distinction, that when the work is rough, and requires much polishing, the coarser powders are best; but, on the contrary, the smoother the work, the less polishing it requires; consequently, the finer powders, in the latter case, are preferable.

" *Directions for polishing soft wood.*

" Soft wood, though nearly the most difficult material, may be turned so smooth, as to require no other polishing than that produced by holding against it a few fine turnings or shavings of the same wood whilst revolving, this being often sufficient to give it a finished appearance: but when the surface of the work has been left rough, it must be rubbed smooth with polishing paper, constantly varying the position of the hand, otherwise it would occasion rings or grooves (if they may be so called) in the work."

"When the work has been polished with the lathe revolving in the usual way, it appears to be smooth; but the roughness is only laid down in one direction, and not entirely removed, which would prove to be the case by turning the lathe the contrary way, and applying the glass-paper; on which account, work is polished best in a pole-lathe which turns backwards and forwards alternately; and therefore it is well to imitate that motion as nearly as possible."

Mahogany, walnut, and some other woods, of about the same degree of hardness, may be polished by either of the following methods. Dissolve by heat, so much bees-wax, in spirits of turpentine, that the mixture, when cold, shall be of about the thickness of honey. This may be applied either to furniture, or to work running in the lathe, by means of a piece of clean cloth, and as much as possible should then be rubbed off by means of a clean flannel, or other cloth. Bees-wax alone is often used; upon furniture it must be melted by means of a warm flat-iron; but it may be applied to work in the lathe, by holding the wax against it, until a portion of it adheres; a piece of woolen cloth should then be held upon it, and the lathe turned very quickly, so as to melt the wax; the superfluous portion of which may be removed by means of a small piece of wood or blunt metal, when a light touch with a clean part of the cloth, will give it a gloss; shell-lac varnish, applied in the manner described under the head of French polish, in page 153 of this volume, is a very superior mode; and although it requires a little more address than the other methods, a very little practice will render it quite easy. A very good polish may be given to mahogany, by rubbing it over with linseed oil, and then holding against it a cloth dipped in fine brick-dust. Formerly, nearly all the mahogany furniture made in England, was polished in this way.

Hard woods.

These, from their nature, are readily turned very smooth; fine glass paper will suffice to give them a very perfect surface; a little linseed oil may then be rubbed on, and a portion of the turnings of the wood to be polished, may then be held against the article, whilst it turns rapidly round, which will in general give it a fine gloss. Sometimes a portion of shell-lac, or rather of seed-lac varnish, is applied upon a piece of cloth, in the way formerly described.

"*Hard wood ornamented or engine-turned.*

"The polish of all ornamental work, wholly depends on the execution of the same, which should be done with tools properly sharpened; and then the work requires no other polishing but with a dry hand brush, to clean it from shavings or dust, this trifling friction being sufficient to give the required lustre."

Ivory and Bone, either plain or ornamented.

Ivory or bone, admits of being turned very smooth; or when filed, may afterwards be scraped, so as to present a good surface. They may be polished by rubbing them first with fine glass paper, and then with a piece of wet linen cloth, dipped in powdered pumice stone; this will give a very fine surface, and the final polish may be produced by washed chalk, or fine whiting, applied by a piece of cloth, wetted in soap-suds. Care must be taken in this, and in every instance where articles of different fineness are successively used, that previously to applying a finer, every particle of the coarser material, be removed; and that the rags be clean, and free from grittiness.

Ornamented work must be polished with the same materials as plain work; using brushes instead of linen, and rubbing as little as possible; otherwise, the more prominent parts will be injured. The polishing material should be washed off with clean water; and when dry, may be rubbed with a clean brush.

Horn and Tortoise shell.

These substances are so similar, in their nature, and texture, that they may be classed together, as regards the general mode of working and polishing them. A very perfect surface is given by scraping; the scraper may be made of a razor-blade, the edge of which should be rubbed upon an oil stone, holding the blade nearly upright, so as to form an edge like that of a currier's knife; and which like it, may be sharpened by burnishing; work when properly scraped, is prepared for polishing; to effect this, it is first to be rubbed with a buff made of woolen cloth, *perfectly free from grease*; the cloth may be fixed upon a flat stick, to be used by hand; but what the workmen call a *bob*, which is a wheel running in the lathe, and covered with the cloth, is much to be preferred, on account of the rapidity of the operation; the buff is to be covered either with powdered charcoal and water, or fine brick-dust and water; after the work has been made as smooth as possible with this, it is followed by another buff, or bob, on which washed chalk, or dry whiting is rubbed; the comb, or other article to be polished, is moistened slightly with vinegar, and the buff and whiting will produce a fine gloss, which may be completed by rubbing it with the palm of the hand, and a small portion of dry whiting, or rotten-stone.

ON JAPANNING AND VARNISHING.—No. 4.

BY THE EDITOR.

Improved mode of applying the varnish in the French polish.

To the information given in our last number, on the subject of the French polish, we add the following improvement, made by Mr. Samuel Nock, and published in the Technical Repository.

"This improvement consists in the substitution of a sponge, with a smooth surface, in place of the coil of list of woolen cloth, or drugget, commonly used.

"Mr. Nock finds the sponge to be far more convenient, for applying the varnish to the surfaces of gun-stocks, than the list, or drugget; as it has no loose hairs, like the latter articles, which are continually protruding through the linen cloths, in which they are inclosed, to the great injury of the process. He also finds, that he can fill the sponge at once with a considerable quantity of the varnish; and can bring it to the surface of the linen cloth, when required at any time, by squeezing the sponge; and he is thus enabled to continue the operation for a much longer time, without renewing the varnish.

"When the sponge becomes clogged with varnish, he moistens it with alcohol; and, putting a coarse linen cloth over it, employs it to prepare the gun-stocks for receiving the varnish; as, also, to remove any former varnish, oil, &c. He, however, always employs a fine linen cloth, in finishing his varnishing.

"He adds, that a Frenchman of his acquaintance, has informed him, that in France, they find the introduction of camphor to improve the varnish."

On Lacker for Brass, &c.

Although, as we have elsewhere observed, the term lackering, is applied to every kind of varnishing performed with lack, yet it is more commonly employed to indicate that process in varnishing, by which the colour of brass is heightened, so as to appear more like gold, or by which a similar colour is given to tin, or leaf silver. In our next number, we will describe the methods by which brass is cleaned, polished, and prepared for lackering; at present, our attention will be given to the mode of preparing and applying the lacker.

To make Gold lacker.

Take seed lack, and carefully pick out the impurities from the clear grains, and, if thought necessary, wash these in clear water, and afterwards dry it perfectly. About three ounces may then be put into a pint of well rectified alcohol; this mixture should be kept in a warm room, and frequently shaken, during two or three days. The whole of the lac will not dissolve, but a sufficient quantity will combine with the alcohol, for the purpose intended. It is best not to strain it through a cloth, but to allow it to stand until the impurities have subsided, and the varnish becomes transparent, when it should be carefully decanted into another bottle. This clearing will require three or four days, and sometimes more, according to the thickness of the varnish. When it is wished to preserve the brass nearly of its natural colour, and merely to prevent its tarnishing, the lacker is used without any additional colour; this, however, is rarely the case, colouring materials being usually added.

Various pigments have been used to tinge the lacker; they are all such as are soluble in alcohol, and the only colours employed, are yellow and red.

Yellows are produced by gamboge, or turmeric root in powder; reds, by arnotta, or by dragons-blood, (*sanguis draconis,*) saffron is also sometimes used for the same purpose. A dram of either of these, may be put into an ordinary vial, and a couple of ounces of alcohol poured on; this will dissolve a portion of the colouring matter, which when clear, may be mixed with the varnish. We have tried all the materials, and prefer the turmeric, and dragons-blood; a few drops of each of these may be put into the lacker; using a larger portion of the turmeric, if a yellow colour be preferred, and of the dragons-blood, if the red is to predominate. It is best not to colour the varnish very highly at first, as it may then be altered according to the nature of the work.

Lacker for tin, or silver leaf.

The only difference in this lacker, and that intended for brass, is that it is more highly coloured, as it is intended to give a gold colour, to a white metal. Many articles, commonly supposed to be gilt, are covered with silver leaf, and afterwards lackered, and when well done, the deception is perfect. When, what was called, gilt leather, was in fashion, it was generally covered in this way.

Directions for using the Lacker.

The lacker, properly coloured, is to be poured into a tin, or earthen cup, a common tea cup, fixed on a block of wood, to cause it to stand firmly, will answer the purpose. It is convenient to have a wire fixed across the cup, just below the rim, in order to scrape the superfluous lacker from the brush. The brushes should be of the flat kind, excepting for small work; they are made of camel's hair, inclosed in tin, with cedar handles, and may be purchased at most of the druggists. The brass to be lackered, must be perfectly bright and clean, the room must be free from dust; a clean piece of linen rag must be at hand, to wipe the work before it is varnished; the sooner it is lackered, after it is finished, the brighter it will be, as polished brass, exposed for an hour or two, will be sensibly tarnished. When it is not convenient to lacker soon after polishing, it is the practice of some workmen to pass the lacker brush once over the article, cold, which prevents the contact of the air; the dull appearance which this produces, is removed in the subsequent operation.

The brass to be lackered, must be heated upon a stove, or in any other convenient way; the degree of heat must not be so great as to render it difficult to hold the work in the hand, nor should it be far below this. The brush is to be dipped in the varnish, and then scraped upon the wire, or upon the edge of the cup, to remove a considerable portion of its contents, otherwise it cannot be laid on evenly. The size of the brush may vary with the work, but one of more than an inch and a half, will rarely be found convenient to use. In laying on the varnish, the brush should always be passed completely from one end of the work to the other, and never backwards and forwards, as in painting, otherwise the lackering will be irregular, and in streaks; nor must it be passed a second time over the same part, until the previous coat is dry; a few seconds, however, suffices for this, when the brass is properly heated. Two or three coats will answer for most work, nor are more than four or five, ever requisite. Work that is thick, will retain heat enough to be finished at one operation; that which is thin, must be heated between every coat. If the varnish is too thick, it will always dry in streaks; a little alcohol is an evident remedy.

Work that is turned and polished in the lathe, may be so heated by the friction, as to be much more conveniently lackered, than when heated in any other way.

The foregoing directions apply only to smooth work, such as is either polished or burnished. Chased, or wrought work, such as leafing, &c. cannot be lackered with the kind of brush before described; one with fine, stiff hairs, called fitch-hair, is used, and this, instead of being passed over the article, is dabbed on, until the surface is regularly covered.

The most careful workmen do not return the lacker from the cup, into the bottle, but pour it into another, where it is allowed to accumulate, and to settle, when it will be as good as at first.

When the lackering is finished, the brush may be scraped upon the wire, and afterwards wiped by pressure between paper. This will be found better than washing it in alcohol, as by allowing it to dry with a little varnish in it, the hairs get a set, which prevents them from straggling, a point of much importance. A few minutes soaking in the lacker, will render it fit for use.

We have repeatedly performed the processes above described, and have now by us, articles which have been lackered nearly eighteen years, which have preserved their colour, and appear equal to any similar work we have ever seen.

Fine Black Colour.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir—Having, some time since, discovered a method of producing the finest black imaginable, and knowing that your valuable Journal is a receptacle for any improvement in the arts, I send you the following recipe.

Take some camphor, and set it on fire; from the flame will arise a very dense smoke, which might be collected in the same way as the lamp-black, in the manufactories of that article. As I have not required much at a time, I have generally collected it on a common saucer, by holding it over the flame. This black, mixed with gum arabic, is far superior to any India ink I have ever seen imported; I have also used it ground in oil.

Yours, &c. T. V. Peticolas.

Nashville, *Tenn*. *Aug*. 1*st*, 1826.

Miniature painters, who use colours in small quantities, sometimes obtain a most beautiful and perfect black, by using the buttons which form on the snuff of a candle, when allowed to burn undisturbed.

These are made to fall into a small thimble, or any other convenient vessel which can be immediately covered with the thumb, to exclude the air. This is found to be perfectly free from grease, and to possess every desirable quality. [*Editor.*

FRANKLIN INSTITUTE.

Committee of Inventions, September 4th, 1826.

The committee of inventions having had referred to them for examination, an auger for boring holes, either square, or of any other desired form, invented by Mr. H. Branch, of the state of New York, and for which he has obtained a patent from the United States,

Report,

That they have carefully examined the instrument, and that it consists of an auger, formed like the ordinary American screw-auger; that the twisted part of the auger is enclosed in a case or socket, extending from the upper part of the twist, to the cutting edge; allowing the small entering screw only, to project beyond it. The external form of the socket is either square or otherwise, according to the intended shape of the hole to be bored, a large portion of its sides being cut away, to allow the chips to escape. The lower end of the socket is of steel, with a sharp cutting edge, bevelled towards the inside. The cutting edges are not allowed to terminate in right lines, but are made concave, so as to admit the angular points to enter the wood first; this causing it to cut with greater ease, and more smoothly than it otherwise would.

The upper part of the socket forms a collar, which works freely on the shank of the auger, just above the twisted part, and is retained in its place by a pin, and other appendages.

When a longitudinal hole, or mortice, is wanted, two or more augers are placed side by side, furnished with their appropriate sockets, and retained in their places by obvious contrivances.

But few instruments have fallen under the observation of the committee, so completely adapted to the attainment of its object; it is at once perfectly simple in its construction, and efficient in operation, boring a square hole, with well defined angles, with nearly the same rapidity, as a round one of the same diameter, and forming it with a degree of truth unattainable by the ordinary methods.

The committee have never seen described, or in use, any instrument, upon the same principle, or which can in any way interfere with it, as an original invention.

By order.

THOMAS P. JONES, *Secretary.*

Improvements in manufacturing paper, and also in type founding.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir—I some time since received a letter, from a relative in Edinburgh, giving some account of Messrs. Cameron & Son's improved machine for manufacturing paper; the letter is accompanied by a printed prospectus, setting forth the great advantages resulting from its use. The price of a machine, complete, is 500 guineas, and the amount of saving in one year, is stated to be £640 8*s.* sterling.

A single machine, is sufficient for a mill of four vats. It produces, in 12 hours, 15 reams of the largest size news, 30 reams of demy, or crown, and 60 of foolscap, or pot paper. It produces a firm, smooth, level paper, of uniform thickness, and perfectly free from air bubbles, water drops, or hemming; exactly square, and with edges nearly as fine as if cut; it is made, sheet by sheet, upon moulds; it comes so dry from the machine, that it will immediately bear any degree of pressure, and will, consequently, dry in about half the time required for paper made in the ordinary way.

The stuff is worked cold, which not only removes the risk of fire, but produces a much higher shade of colour, whilst there is a degree of cleanliness, not attainable in the ordinary process of manufacture.

The patentees state, that no description, or drawing, could convey any idea of its utility and perfection; and that to be judged of, it must be seen at work.

The writer of the letter has seen it in operation, and says, that it completely justifies the foregoing account. The complexity of the machine, and his want of skill in drawing, prevented his giving an intelligible description of its construction; all that I can gather from his account, is, that a number of frames are carried round in the trough, by an endless chain; and that at a particular part of the operation, the frames cant themselves over, and the paper is received between two felts, which then pass through rollers, when the paper is delivered nearly dry.

I have also received from Messrs. Didot, Legrand, & Co. of Paris, a notice of their Polyamatype Foundry. The improvement consists in casting at once, a great number of letters, from 100 to 160, according to the size of the type.

Two workmen of ordinary address, will fill the mould three hundred times in a day, and can, consequently, cast from 30 to 48,000 letters, or 40,000, on an average. This is said to be equal to the work of from 12 to 15 men, upon the old plan.

The letters are pronounced to be uniformly more perfect, than those formerly produced.

So great is the saving by this process, that the manufacturers state their prices to be 30 per cent. below those of other founders in Paris, although the latter sell 30 per cent. cheaper than the London prices.

Very respectfully, yours, A.

Notice of the Glass Blowing, Cutting, and Porcelain Manufacture, at Jersey City. By the Editor.

In a recent visit to New York, we crossed to Jersey City, to examine the manufactories of glass, and china, which are established there. Although we had heard them spoken of in this city, we had not formed any correct idea of their extent, and importance. When these works were first established, strangers were freely admitted; but the workmen were so much interrupted by the idle curiosity, and aptitude at meddling, displayed by many of the visitants, that it has been found necessary to close the doors, excepting an order be obtained from the managers.

The glass house has two principal departments, one for the blowing, and the other for cutting. The former, is under the direction of Mr. Glaze, the latter, under that of Mr. Young. Most of the glass that is blown, is intended to be cut; it is remarkably clear and colourless, and free from veins and blebs; and the forms given to their pitchers, vases, dishes, and other articles, are in very good taste.

The cutting room exhibits a scene of active industry, combined with the most perfect order, resulting, in part, from the neat and judicious arrangement of the machinery, but, undoubtedly, in a still higher degree, from the excellent management of its conductors. There are in one room, thirty-two wheels for cutting, the whole of which are driven by a steam engine. Twelve other wheels are in preparation, which are to be fixed in another room, and to receive their motion from the same source. Every wheel was occupied, and although the establishment is of comparatively recent origin, there is an appearance of maturity about it, that augurs well.

The specimens which we examined, and these were not few, were cut with great regularity, and well polished. Some of the best, we were assured by the superintendant, were, both in design and execution, the work of boys who had been but a few months at the business.

The porcelain manufactory is under the direction of Mr. Shirley, a gentleman brought up to that business in England, and who has also spent a considerable portion of time in France, making himself acquainted with the methods pursued in that kingdom. He has under his direction, workmen from both countries. The ware is much superior to any thing we had expected to find there. The principal articles which we saw, were either of white biscuit, or of white and gold, in the French style. The texture, and the colour, are equal to that of the china imported from France; the surface clear and regular, and the gilding, in general, well done. We have in our possession, a custard cup, taken at random, from a number, which will justify these remarks. We hope to see specimens from both establishments, at the approaching exhibition of the Franklin Institute.

The glass works, we believe, belong entirely to Messrs. George Dummer & Co. of New York. The porcelain establishment is also owned, in great part, by them, the shares into which the stock is divided, not having been taken up. In consequence of this, the business does not appear to be carried on with the same spirit as that of the glass works; and we were, somehow, impressed with an idea, that it does not give the same promise of permanence: we, however, were very transient observers, and hope, that, in this instance, we were more moody than correct.

We also made a flying visit to Albany; and the only mechanical trophy which we brought away with us, is a wrought iron spike, made by machinery, at the works of the Messrs. Townsend, near that city. The rapidity with which they are made, is astonishing, and they are preferred by the ship builders, to those made by hand. We had not time to visit the works, and therefore cannot speak more fully upon the subject; we ascertained, however, that they are formed by pressure.

NATURAL HISTORY.

THE PRAIRIE OR BARKING WOLF.*

Canis Latrans; SAY.

Canis Latrans: SAY. Long's Expedition to the Rocky Mountains, vol. i. p. 168. A well prepared specimen in the Philadelphia Museum.

This wolf frequents the prairies, or natural meadows of the west, where troops or packs containing a considerable number of individuals are frequently seen following in the train of a herd of buffalo or deer, for the purpose of preying on such as may die from disease, or in consequence of wounds inflicted by the hunters. At night they also approach the encampments of travellers, whom they sometimes follow for the sake of the carcasses of animals which are relinquished, and by their discordant howlings, close to the tents, effectually banish sleep from those who are unaccustomed to their noise. According to Say's observation, they are more numerous than any of the other wolves which are found in North America.

The barking wolf closely resembles the domestic dog of the Indians in appearance, and is remarkably active and intelligent. Like the common wolf, the individuals of this species, frequently unite to run down deer, or a buffalo calf which has been separated from the herd, though it requires the fullest exercise of all their speed, sagacity and strength, to succeed in this chase. They are very often exposed to great distress from want of food, and in this state of famine are under the necessity of filling their stomachs with wild plums, or other fruits no less indigestible, in order to allay in some degree, the inordinate sensations of hunger.

This wolf barks in such a manner as to resemble the domestic dog very distinctly; the first two or three notes are not to be distinguished from those produced by a small terrier, but differs from that dog by adding to these sounds a lengthened scream. On account of this habit of *barking*, Say has given the specific name of "latrans" to this wolf, which we prefer to translate for a trivial name, instead of using that of "*prairie* wolf" which is equally applicable to other species.

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* From Godman's American Natural History.

In confirmation of the sagacity of this wolf we shall quote from Say, to whom we owe all that has yet been made known of this species, some anecdotes respecting it. "Mr. [Titian] Peale constructed and tried various kinds of traps to take them, one of which was of the description called a "live trap;" a shallow box reversed and supported at one end by the well known kind of trap-sticks, usually called the "figure four," which elevated the front of the trap upwards of three feet above its slab flooring; the trap was about six feet long, and nearly the same in breadth, and was plentifully baited with offal. Notwithstanding this arrangement, a wolf actually burrowed under the flooring, and pulled down the bait through the crevices of the floor: tracks of different size were observed about the trap. This procedure would seem to be the result of a faculty beyond mere instinct."

"This trap proving useless, another was constructed in a different part of the country, formed like a large cage, through which the animals might enter, but not return; this was equally unsuccessful; the wolves attempted in vain to get at the bait, as they would not enter by the rout prepared for them. A large double "steel trap" was next tried; this was profusely baited, and the whole with the exception of the bait was carefully concealed beneath the fallen leaves. This was also unsuccessful. Tracks of the anticipated victims were next day observed to be impressed in numbers on the earth near the spot, but still the trap with its seductive charge, remained untouched. The bait was then removed from the trap and suspended over it from the branch of a tree; several pieces of meat were also suspended in a similar manner from trees in the vicinity. The following morning the bait over the trap alone remained. Supposing that their exquisite sense of smell warned them of the position of the trap, it was removed and again covered with leaves, and the baits being disposed as before, the leaves to a considerable distance around were burned; and the trap remained perfectly concealed by ashes; still the bait over the trap was avoided."* It was not until a log-trap was used, that an individual of this species was caught. This log-trap is made by raising one log above another at one end by means of an upright stick, which rests upon a rounded horizontal trigger on the lower log.

The barking wolf is about three feet and a half in length, of which the tail forms thirteen and a half inches, exclusive of the hair at its extremity. The ears are four inches long, from the top of the head; and the distance from the anterior canthus of the eye, to the end of the snout, is three inches and three-fourths.

The general colour of the barking wolf is cinereous, or gray, intermingled with black, and dull fulvous, or cinnamon, above. The hair is of a dusky lead colour at base; of a dull cinnamon in the middle of its length, and gray, or black, at tip, being of greater length along the middle of the back than on other parts of the body. The ears are erect and rounded at tip, having the hair on the back part of a cinnamon colour, and dark plumbeous at base, while that on the inside is gray. The eyelids are edged with black; the superior eyelashes are black beneath, and on the superior surface of their tips. The supplemental lid is margined with black brown, before, and edged with black brown, behind. The iris is yellow, and the pupil of a black blue; upon the lachrymal sac, is a spot of black brown. The face is cinnamon coloured, tinted with grayish on the nose; the lips are white, edged with black, and have three series of black bristles. The colour of the head between the ears is an intermixture of gray and dull cinnamon; the colour of the sides is paler than that of the back, and faintly banded with black above the legs, which are cinnamon coloured on the outside, and more distinctly so on the posterior hair. The tail is straight, broad and bushy, of a gray colour, mingled with cinnamon above, and black at the tip. The extremity of the trunk of the tail reaches to the projection of the os calcis, when the leg is extended.

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* See Journal of Long's Expedition to the Rocky Mountains, vol. i. p. 168.

Different individuals exhibit very considerable variations in colouring, and hence many of the minute markings given by Mr. Say, in the above description, may not be found applicable. He states himself that other specimens which he saw differed much from his first description; one "was destitute of the cinnamon colour, except on the snout, where it was but slightly apparent; the general colour was therefore gray, with an intermixture of black, in remote spots and lines, varying in position and figure with the direction of the hair." Perhaps no two individuals could be found exhibiting throughout precisely the same arrangement of coloured markings.

Hancock's invention for cooling boiling worts in Brewing.

Wiveliscombe, Somersetshire, June 7, 1826.—Therm. 68°.

Sir—Through your extensively circulated publication, I would wish to communicate to your correspondents, and the public, an invention of a Mr. Hancock, a very ingenious and intelligent man, who has paid great attention to the art of brewing, and the mode by which its various processes may be condensed and facilitated. I visited Mr. Hancock's brewery this morning, and witnessed an experiment, which, to me, appears of vast importance to the science of brewing. It is agreed by all parties, that those who are engaged in extensive concerns of this description, find a considerable difficulty in reducing the temperature of their worts, to the point necessary for a perfect fermentation; but Mr. Hancock completely obviates these difficulties, by the following process:—A leaden pipe, three-quarters of an inch calibre, is encased in another leaden pipe of about double its diameter, and is inserted into the copper, or other vessel, containing the boiling liquor. These two pipes are coiled around the walls of the building, to preserve a plane of inclination, which will allow the wort, or liquor, in the minor pipe, to escape, at the rate of two hogsheads per hour, and is let off by a stop-cock, whilst the space between the outer and inner pipe, is filled with cold water, which passes rapidly through it, and carries off the caloric of the boiling wort, or liquor, whose temperature is reduced two degrees below the measure of the atmosphere; thus effecting a diminution of temperature from 212° of Fahrenheit's thermometer, to 66°, and cooling at the rate of fourteen hogsheads in seven hours, which could not be effected in double that time by the usual process. We have here, an apparatus, bold, decisive, and simple; requiring no care, trifling labour, and not likely to be out of repair; and, what is of more consequence, of the cheapest materials. I have been informed, that some one has claimed a patent for a very complex machine, designed to cool boiling worts; but the simplicity of Hancock's apparatus, must supersede all others, liable to have their parts discomposed in the working. Mr. Hancock, who is most liberal in communicating his improvements to the public, will feel obliged by any of your correspondents communicating their sentiments to him, through the medium of your excellent publication.

I have the honour to be, sir, your obedient servant,

HENRY SULLY, M. D.

[*Lond. Mech. Mag.*

Account of the Process of MM. Thenard and Darcet, for Preserving Substances from Humidity.

On the 27th of February, 1824, there was read at the Academy of Sciences of Paris, a Memoir, by MM. Thenard and Darcet, on the employment of fatty bodies, for making coverings, and unalterable plasters, and for making moist places salubrious. This process, the effects of which have been established by several years experience, consists in causing a mixture of one part of oil, and two parts of resin, to penetrate, by means of an intense heat, either porous stones, or plaster. The bodies penetrated with this mixture, acquire afterwards a singular degree of solidity, and become absolutely impermeable to moisture.

This process may be employed, for rendering low and damp places salubrious. It was tried at the Sorbonne, and the expense of it was only 16 sous per square metre, or a square whose side is 39 English inches. The other objects, to which it is proposed to apply it, are houses, statues placed in the open air, bas reliefs and sculptures in plaster, the ceilings and walls of rooms intended for Fresco paintings, basins for holding water, and reservoirs for holding grain.

M. Thenard exhibited to the Academy, several objects of art, executed in plaster by his process. In order to show its efficacy, he exposed to the open air, for several years, a bas relief, half of which was formed of ordinary plaster, whilst the other half was prepared. This last half was perfectly preserved, while the other displayed visible traces of disintegration. This process does not resemble those which consist in covering bodies with a sort of skin, which keeps off humidity. The body is actually penetrated with the mixture, to the depth, sometimes, of several inches.

The Editor has commenced a more detailed account of the preceding process, as published in the *Annales de Chimie et de Physique*, for May last; but not having completed the translation of the article, its appearance is necessarily delayed until next month.

*A fragment of Roman Glass, found near Brool.**

The invention of glass (says Dr. Rudolph Brandes) is known to be very ancient; nevertheless, few antique remains of it have come down to us, or have been analyzed.

Although the art of manufacturing glass was not carried to that degree of perfection among the ancients, to which it has been brought in our days, still, in some branches of it, they had gone very far, as has been sufficiently shown by the learned investigations of Winkelmann.

The piece of glass which I obtained from M. Dorow, was a fragment of a round vase, and weighed about ten grains. Its colour was of a milky white, with a very bluish cast. A pellicle of a brilliant gold colour, covered its exterior, and, in part, its interior surface. This had so much the appearance of gilding, that without a chemical trial, one would have taken it to be gold; but I shall show below, that this was not the case. The long period of time, during which the glass had been exposed to the effects of the air, water, and the pressure of the earth, had made a visible impression on it; so much so, that it was in a mouldering state, had entirely lost its firmness and brittleness, and when broken, pressed, or scraped, fell into small leaves, like mica. It had completely lost its transparency, but it was still evident, from its appearance in the centre, that it was originally perfectly transparent, that part, from having somewhat resisted the destructive effects that had acted upon the rest, being so still. Wherever the glass was covered with the gold-like pellicle, it was not transparent; but where free from it, it was perfectly clear.

By endeavouring to separate that covering, no gold-leaf was detached, but thin leaves of glass; and the surface beneath soon offered a similar appearance. In some places, that metallic tarnish assumed a fine bluish red, or green hue; and a similar appearance was produced, by taking off the apparently metallic pellicle which was on the inside. This shows, that the cause of this tarnish was the same as that which acts upon glass long exposed to the weather—such as in old church windows, for instance; and which has a similar appearance. However, to convince myself completely of the absence of gold, I heated as many as possible of the shining glass leaves, in nitric acid, by which process, the gold-coloured covering entirely disappeared, and the leaves remained without colour. The component parts of the glass, I found to be silica, soda, lead, oxide of manganese, oxide of iron, lime, and alumina. Of these constituents, the silica formed about two-thirds, and the other substance the remaining third of the whole mass.

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* From Schweigger's Journal, Band. x. p. 304

New Steam Carriage.

We have just had an opportunity of examining a steam carriage which has lately been constructed, in the most private manner, under the direction of Mr. Gurney, of Argyle-street, and which is now so near its completion, that a brief description of it, while it cannot fail to interest the public, to whose notice it is on the point of being presented, will scarcely be considered as unfair or injurious to the proprietor, by giving a premature publicity to his ingenious and original invention.

Considering the great weight and unwieldy character, generally, of ordinary steam machinery, perhaps the most remarkable particular connected with Mr. Gurney's new carriage, and that which will strike the observer with most surprise, is the extraordinary lightness and elegance of its external appearance. Looking at it with reference to the ordinary carriages at present in use among us, its appearance is something between that of the regular mail, and the common Telegraph stage-coach. Indeed it more nearly resembles those light carriages which are at present driven four in hand, by our young bloods in the Parks and about town, than any other vehicle with which we are acquainted. The body of it is not larger—it has the same kind of fore and hind boot, the same size box, dickey, &c. And, what is still more remarkable, it has, so far as relates to all the above particulars, nothing belonging to its appearance, which can distinguish it from one of the above carriages—nothing which they have not, or which can indicate that it is intended to be moved in any other than the ordinary manner. On looking however, before Mr. Gurney's carriage, at that spot which is in ordinary carriages occupied by the pole, &c. and also beneath it, we perceive in what it differs outwardly from others. Immediately in front, at about 7 or 8 feet in advance of the fore wheels, is placed an oblong box or boot, with a single wheel beneath it, and a dickey seat above it, out of which rises a high pillar. And underneath the body of the carriage, are several other pieces of machinery.

It is by means of these objects, that the carriage is moved, by the intervention of steam; not on the ordinarily understood principles of that power, but by contrivances and arrangements, that appear to be altogether new; since the whole weight of this machinery, for generating and applying the required steam, amounts to but one-twentieth part of that which has hitherto been considered as necessary; and without this relative weight of machinery, no successful attempt has yet been made to apply steam, practically, to the arts of life. The steam-machinery attached to this carriage, is estimated to possess, what is called, an eight horse power; and yet the weight of the whole, including the cylinders, (of which there are two, instead of one,) amounts to little more than about 500 pounds; whereas the ordinary weight of the machinery hitherto required to generate the above mentioned power, is not less than six tons. The diminished bulk is also in proportion to the diminished weight. With respect to the arrangement of the machinery in Mr. Gurney's carriage, the boiler is contained in the oblong, or boot, which we have described as placed in advance of the carriage itself—one on either side the perch. Thus, all the ordinary parts of the vehicle, are left for the purposes to which they are usually applied in carriages—the interior, and the hind and fore dickies, for passengers; and the hind and fore boots for luggage, &c. But one of the principal novelties in this carriage, remains to be mentioned. In the various unsuccessful attempts, which have hitherto been made to use steam for the purpose of moving carriages along public roads, it has been the invariable practice, to apply the power exclusively to the wheels; and the consequence has been, that when any considerable resistance has been encountered, from extraordinary weight, rising of the road, &c., the wheels, having no hold of the ground, have not been able to overcome it. Now, in Mr. Gurney's carriage, the power can, when necessary, be applied, without any reference whatever to the wheels, and precisely in the same manner that locomotive power is applied on man, and other animals—namely, by means of propellers, or feet, placed underneath the carriage, and acted upon immediately by the steam machinery, when any extraordinary resistance presents itself. But though the propellers, or feet, of this carriage, are the most striking features belonging to it, the boiler strikes us, as being by far the most important; as that, if adequate to its purpose in the present instance, must be available in a vast variety of other ways, in which steam has not hitherto been applied, on account of the great weight and bulk of the boilers required to generate it.

A paragraph appeared in all the papers, stating that government has taken up Perkins's steam engine. This is incorrect; it is Mr. Gurney's locomotive engine and boiler, that the Admiralty have noticed, and have put the Comet steam vessel, at Deptford, under his care, for his experiments. The mistake arises thus: Mr. Gurney has recently taken possession of the factory, and premises, in which Mr. Perkins made the trial (which failed) of his steam gun, and is there prosecuting to completion, his engine, boiler, and steam coach, &c.

[*London Paper.*

Steam Engines.

Within the last twelve months, upwards of fifty patents have been taken out, in England and France, for steam engines; indeed, since the much-discussed improvement of Perkins, steam engine projectors seem to have run mad. The characters, or designations, of the new engines, have thus been rendered so multifarious, that it would be difficult to enumerate their nomenclature. We have atmospheric, hydraulic, pneumatic, and gaseous engines; on the respective merits of which, we presume not to decide, as they are chiefly known to the public, through the advertisements of their inventors; and we have not learnt, that any one of them is practically at work. From this sweeping clause, we are assured, that Mr. Gurney's engine and steam carriage may be excepted, as he has completely attained two grand objects; he has simplified the steam engine, to one-fifth of its complex machinery, and he has rendered steam of 80 pounds to the inch, as safe as the boiling over of a tea kettle. These new engines will, it is further stated to us, cost about one-half the price of any of the others; a boiler on the new construction will weigh only 4 cwt., whereas on the old plan it would weigh 4 tons; and, by calculations made for the Board of Admiralty, it appears that the government steam-packet engines, with their charge of water, weigh 111 tons; whilst these to be put in use will not exceed 6 tons: that the space occupied by the present engines is 4600 cubic feet, and that the new ones will only occupy 600 feet; thus obtaining an advantage of 105 tons, and 4000 cubic feet space, for goods and passengers. Government has given up the *Comet* steam-packet to Mr. Gurney for an experiment, which, if relieved only one-half of the extent supposed, will confirm this to be one of the important discoveries of modern times. It may be added, that if this steam-engine boiler succeeds as expected, it will produce a new era in the art of dying, as steam-boilers, superior to any in use, will by its means be produced; it will only weigh a couple of hundred weight, may be placed on wheels, and moved about wherever it may be required: in fine, wherever water is wanted to be heated, or steam of a high temperature obtained in a few minutes, this boiler must always command a preference; and we suppose the patentees will find it their interest to manufacture it independent of the engine. [*ib.*

Burstall and Hill's Steam Carriage.

We have still delayed the publication of this invention (as of several others,) in the expectation of seeing something realized of which a satisfactory account might be given, but we have yet only the following to communicate, which is extracted from a letter of Mr. Burstall's received by us within these few days.

"Since we had the pleasure of your company at Leith, we have made many improvements, and at last are in a fair way to produce a complete machine. We have had much trouble with the boiler, and though we knew the last we made was very defective, yet we determined to make a trial, which took place in the night, ten days since; you will understand the difficulty we laboured under when I tell you, that our steam could not be kept up more than two minutes at a time, yet we got her, with care, to travel at the rate of full seven miles per hour, and as the steam by that time was getting very low, I am satisfied with a proper boiler, double that velocity will be quite easy.

"The steam makes no alarming noise, and as the coach will be better, for the roads, than the horse coaches, we are now sure of full success: Mr. Hill is in England, superintending the making a boiler, which will put us all right.

"My view is, that, it may be six weeks, or two months, before we shall be able to make our complete machine public."

[*London Journal of Science.*

Prize Chronometers.

The Lords Commissioners of the Admiralty, with a view of affording the utmost possible aid to navigation, and encouragement to the mechanic arts, have instituted two annual prizes, for the two best chronometers that could be produced, viz. £300 for the best, providing the error of its mean daily rate, when *doubled, added to the mean of its extreme variation, shall not exceed six seconds;* and £200 for the second best, providing its errors, on the same principle, shall not exceed *ten seconds*, after *twelve months*' trial at the Royal Observatory, Greenwich, each competitor being allowed to put in two; and from the Monthly Reports it appears that forty-eight were admitted on trial on the 1st of May, 1825. By the following official documents from the Royal Observatory, it appears that the two prizes have been awarded to Mr. J. M. French, Royal Exchange, his chronometers having far exceeded in accuracy any thing on record. The variation of No. $\frac{20}{3912}$, entitled to the first prize, having been only six tenths of a second in the twelve months on its mean daily rate; three tenths during the last nine months; and under one tenth of a second during the last four months of the trial; and No. 975, entitled to the second prize, varied less than a second during the twelve months.

They were the only two, within the limits of the first prize at the end of the trial.

This is a triumph alike honourable to the mechanic arts, and to the Government that appreciates them.

The Mean Daily Rates and Extreme Variations of Two Chronometers, by Mr. J. M. French, of the Royal Exchange, during their Trial at the Royal Observatory, from May 1, 1825, *to May* 1, 1826.

	No. $\frac{20}{3912}$		No. 975		Extreme of Temperature at noon.
	Mean Daily Rate.	Extreme Variation.	Mean Daily Rate.	Extreme Variation.	
	″	″	″	″	° °
1825—May	4,75	1,3	2,71	1,4	66 to 54
June	4,30	1,7	2,54	1,5	75½—54
July	4,14	1,6	1,93	2,8	82 —63
August	4,43	1,4	2,30	0,9	76 —63
September	4,50	0,9	2,36	1,1	74 —60
October	4,65	1,2	2,79	1,4	64 —45
November	4,57	1,2	2,92	1,6	55 —39
December	4,36	1,4	2,51	1,9	53 —36
1826—January	4,52	2,2	2,20	1,4	45 —25
February	4,58	1,3	1,97	1,3	51 —89
March	4,52	1,5	2,07	1,4	60 —39
April	4,50	1,1	2,26	1,1	60 —45

The two annual premiums of £300 and £200, have this year been awarded to Mr. J. M. French, for the above two chronometers.—Royal Observatory, May 12, 1826.

Royal Observatory, May 15, 1826.

"Sir—Having transmitted to my Lords Commissioners of the Admiralty a report of the merit of chronometers on the late trial, their Lordships have been pleased to approve of the two annual premiums of £300 and £200, being given for your chronometers, No. $\frac{20}{3912}$ and 975, and by your enclosing me a bill for the same, it will be forwarded for payment.

"I am, sir, your obedient servant, for *J. Pond*, Esq.

(Signed) Thomas Taylor.

"Mr. J. M. French, Royal Exchange."

Canal through the Isthmus of Panama.

The government of Guatemala has granted to A. H. Palmer, esq. and others of the city of New York, the right to open a direct canal communication for ships, from the Atlantic, to the Pacific ocean, through the river San Juan, and the lake Nicaragua, with the privilege of an exclusive navigation for twenty years. This important grant was obtained recently, from the government of Guatemala, through the presence of col. Williams, our minister, by col. De Beneski, agent for the company, who arrived in this country early in the present month, after having accomplished his purpose: and who was recently in this city.

The whole extent of excavation, we are informed, will not exceed 17 miles (the distance between the lake and the river,) which will require a lockage of 200 feet. The work is required to be completed in 18 months, and it is said will be commenced with 6000 men from this country. An attempt will be made (and doubtless a successful one) to obtain an act of incorporation of the legislature of this state. The style of the company is the Atlantic and Pacific Ocean Company.

The agent of an English company was desirous to obtain the grant, or to participate in the advantage of it, and offered a large bonus for the privilege; but it is a source of gratification that the enterprise, skill and means of our own countrymen, have been charged with the execution of this truly great undertaking. It can scarcely fail to be a source of wealth to the company, and advantage to the whole commercial world.

The Boston Daily Advertiser, states that Col. De Beneski, waited on the President, at Quincy, with despatches from our commercial agent at Guatemala, authenticating the intelligence communicated in the foregoing article. The government of Central America, called for proposals for such an undertaking about a year since, and several companies have been formed, it is said, in Europe for the purpose, and have presented their claims. The company with whom the contract is now made, are to have the right of toll, and certain exclusive privileges, which the persons interested think of great value. It is supposed that the undertaking will receive countenance from the government of the United States. The persons now composing the company in New York, propose to extend it through all parts of the Union, making it as much as possible a national concern, and will apply to Congress, it is said, for incorporation, by the name of "THE CENTRAL AMERICAN AND UNITED STATES ATLANTIC AND PACIFIC JUNCTION CANAL COMPANY," with a capital of $5,000,000.—The undertakers are very sanguine as to the practicability of the scheme, and the profit of the speculation, as well as the national and commercial advantages to be derived from its execution. We understand they mean shortly to solicit the co-operation of our capitalists, and exhibit a detailed exposition of their views.

Protection of Ships in Storms.

Mr. Delafons, of George street, Hanover-square, has invented a machine, which, although very simple in its construction, is likely to prove more beneficial to society, than any similar discovery that has been made for many years. It is calculated to afford security against the possibility of ships being driven from their moorings in bad weather, and a certain protection against their going on shore, however violent the storm; a calamity that annually occasions the loss of numbers of lives, and of property to a great amount. The government are, we understand, in treaty with Mr. Delafons, for the purchase of this humane and useful discovery, for which he has taken out a patent.

List of Patents issued in the United States, from the 10th of May, to the 6th of June, and from the 21st of June, to the 31st of July, 1826.

Improvement in the combined lever cotton press, May 10, E. Venear, North Carolina.

In relieving water wheels from obstructions of back-water, May 10, Jare Benedict, New York.

In the machine for thrashing grain, May 10, John Shaw, Maine.

In covering, or platting, brick kilns, May 10, S. R. Bakewell, Virginia.

In the machine for excavating canals, &c., May 10, Lot Forrester, Connecticut.

In the method of forming schemes and tickets of lotteries, and for drawing the same, May 16, Edward Grattan, Rhode Island.

In boys' dresses, May 16, Charles Herwick, New York.

In sponges for artillery, May 16, John Gethen, Philadelphia.

In making cordage, May 17, E. Bartholomew, Boston.

In making chain cables, called the swedge hammer, May 17, E. Bartholomew, Boston.

In the art of manufacturing bread, May 18, E. Treadwell, New York.

In the mode of constructing water wheels and flumes, May 18, Asa Messer, Rhode Island.

In the circular saw, May 18, Wm. Kendall, jr. Maine.

In the family spinning machine, May 20, J. Watt, A. Prest, and G. Freeborn, Ohio.

In the machine for sawing felloes for wheels of carriages, &c. May 20, P. Collier, New York.

In the art of ornamenting walls, ceilings, &c. May 20, Wm. West, Philadelphia.

In furnaces for heating iron hoops for carriages, May 22, Garret Post, New York.

In pumping water for propelling machinery, May 22, Liscomb Knap, New York.

In the machine for raising water for domestic purposes, May 22, Liscomb Knap, New York.

In the press for pressing out cider, oil, and other liquids, May 20, Wm. H. Hoeg, Ohio.

In pressing Leghorn, straw, and other hats, May 23, R. Tyler and B. P. Coston, Philadelphia.

In the mode of loading carts, or wagons, with earth, May 23, Noah Osborn, Connecticut.

In the steam-packed rotary steam engine, May 25, S. Fairlamb and D. Bruce, jr. New York.

In the construction of saddles, May 27, Wm. H. Collins, Ohio.

In removing earth from canals by inclined rail-way, May 29, Wm. H. Doll, Pennsylvania.

In the machine for finishing or ironing fur, wool, or other hats, May 31, J. Cooper and T. Barnett, Philadelphia.

In the machine for removing earth, June 1, P. Reading, New Jersey.

In the construction of wind mills, June 1, Wm. Coburn, Maine.

In the lever press for packing cotton, and other articles, June 3, Charles Williams, Virginia.

In the thrashing machine, June 3, P. Reading, New Jersey.

In the thrashing machine, May 25, Seth Ballou, Maine.

In the springs to a wagon-seat, June 6, Walter Janes, Connecticut.

In the construction of rail ways, so that teams may pass each other on the same, June 6, J. Brown and G. W. Robinson, Rhode Island.

In relation to the evolution and management of heat, June 21, E. Nott, New York.

In the shaving and smoothing of wood, June 21, A. Brownson, New York.

In the machine for spinning flax and hemp, June 22, W. Hunt and W. Hoskins, New York.

In the buoyant dock, June 22, Maximin Isnard, New York.

In the machine for pressing unburnt brick and tile, at one operation, June 24, Ephraim Mayo, Maine.

In the machine for planting and working Indian corn, June 24, William Ross, Pennsylvania.

In cutting plugs for waists and decks of shipping, June 28, C. Josselyn, New York.

In the mode of sawing wood, slitting boards, and sawing felloes, by machinery, at one operation, June 24, B. Ruggles, Vermont.

In grist mills, June 29, Isaac Ryon, Massachusetts.

In the "Franklin Duplex Steam Generators," July 1, John M'Curdy, England.

In the 30 hour wooden wheeled clocks, July 5, Eli Terry, Connecticut.

In the washing machine, July 6, Seth Church, New York.

In the steering wheel, July 10, E. S. Coffin, Boston.

In steering vessels by the compound lever wheel, July 10, Rhodes Kinsbury and Edward Rowse, Maine.

In the braiding machine, July 10, John Thorp, Rhode Island.

In the scale for draughting garments of every variety of fashion and form, July 10, Nathan B Starr, Philadelphia.

In the mode of preserving timber used in the construction of wooden locks for canals, July 10, Simeon Guilford, Pennsylvania.

In the cleave harrow for clearing swampy grounds, July 11, Lemuel Tam, Delaware.

In manufacturing salt by evaporation, and in heating liquids by the use of stoves and stove pipes immersed in cisterns, July 12, Stephen T. Conn, George-Town, Delaware.

In raising and removing earth, opening water courses, and making canals, July 14, Cyrus Barnard, Pennsylvania.

In making cartridges for blasting rocks, July 17, John B. Ives, Pennsylvania.

In the mode of letting water on water wheels, July 18, Thos. Key, Georgia.

In the steam generator, July 20, Stephen T. Conn, Georgetown, D. C.

In the mode of applying steam power to the sawing of timber, July 21, R. Nichols, New Orleans.

In spinning cotton and wool, July 24, Joseph Hathaway, New York.

In evaporating liquids, July 26, Charles Sholes, New York.

In the construction of grist mills for grinding Indian corn, &c. July 31, J. Northrop, Connecticut.

In the machine for grinding shelled corn, &c. July 31, J. Webster, Philadelphia.

List of New Patents, in England, which have passed the Great Seal, since June 22, 1826.

To Thomas Halahan, for Machinery or Apparatus for working Ordnance. Dated June 22, 1826.

To Lewis Aubrey, for an improvement or improvements in the Web or Wire for making paper. Dated July 4, 1826.

To John Poole, for certain improvements in Steam Engine Boilers, or Steam Generators, applicable also to the evaporation of Fluids. Dated July 4, 1826.

To Daniel Freeman, for improvements in measuring and making Collars for Horses and other Cattle. Dated July 4, 1826.

To Peter Groves, for certain improvements in manufacturing or making White Lead. Dated July 4, 1826.

To Robert Wornum, for certain improvements on Piano-fortes. Dated July 4, 1826.

To Peter Groves, for certain improvements in making Paint or Pigment, by preparing and combining a substance or material with Oil, Turpentine or other ingredients. Dated July 10, 1826.

To Benjamin Lowe, for certain improvements in useful and ornamental Dressing Pins. Dated July 14, 1826.

To John Guy and Jacob Harrison, for an improved method of preparing Straw and Grass to be used in the manufacture of Hats and Bonnets. Dated July 14, 1826.

To John Palmer De Lafons, and William Littlewort, for an improvement in securing or Mooring Ships, and other Floating Bodies, and Apparatus for performing the same. Dated July 14, 1826.

To Edward Bayliffe, for certain improvements in the machinery used for the operation of Drawing, Roving, and Spinning of Sheep and Lambs' Wool. Dated July 14, 1826.

To John Lane Higgins, for certain improvements in the construction of Cat-blocks and Fish-hooks, and in the application thereof. Dated July 14. 1826.

NOTICES.

Lectures at the Franklin Institute.

The new Hall of the Institute, will be opened for the season, on Monday, the 6th of November, on which occasion, an address will be delivered by Dr. Patterson.

The introductory lecture, of the Professor of Mechanics, will be delivered on the 7th, and Dr. Bache's lecture, introductory to his course of chemistry, and its application to the arts, on the 9th of the same month. The hour of lecturing will be half past seven o'clock in the evening.

Saturdays are reserved for volunteer lectures.

A member's ticket, which costs but THREE DOLLARS PER ANNUM, will give admission to all the lectures; and a ticket, for the season, admitting a member's son, or apprentice, may be procured for ONE DOLLAR.

☞ The evening schools, for Drawing, and for Mathematics, commence with the present month.

LECTURES ON CHEMISTRY.

Dr. Thomas P. Jones, will deliver a course of lectures on chemistry, at the Hall of the Franklin Institute, during the ensuing winter.

The general principles of the science, and their application in accounting for many of the phenomena of nature, and a variety of processes in the arts, will be familiarly explained, and illustrated by numerous and brilliant experiments, for which purpose Dr. J. has the command of an extensive apparatus.

Tickets, admitting a lady and gentleman to the course,	12 dollars,
Tickets for a gentleman only,	8 dollars.

The lectures will be delivered at 7 o'clock, in the evening. Further particulars will be made known by advertisement in the public papers.

TO SUBSCRIBERS.

Those who have not paid their subscription for the year, are reminded that it is due. Those who do not pay before the commencement of the next volume, will be considered as having relinquished the work, as it is determined not to allow two years' subscription to become due from any individual. New subscribers, residing in the country, where there is no regular agent, must remit the amount of a years' subscription, at the time of subscribing; in which case, the latitude of a second year will be allowed for their next remittance.

Belidor, came to hand, just as the present number was finished. We have seen the engine in New York, to which he refers. We shall publish some remarks upon the subject in our next, together with B.'s communication.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS, AND GENERAL SCIENCE.

NOVEMBER, 1826.

FRANKLIN INSTITUTE.

At the late annual exhibition of American manufactures and inventions, a large model of an Inclined Plane, intended as a substitute for locks, in raising and lowering canal boats, from one level to another, was deposited by the inventor, Professor James Renwick, of Columbia College, New York. In order to insure that attentive consideration, which was demanded by the importance of the subject, it was referred to a special committee: the report of this committee, contains a view of the subject, so full and satisfactory, that notwithstanding its length, the publication of it, will, undoubtedly, be acceptable to our readers.

Report of the Committee of the Franklin Institute, on the Inclined Plane of Professor James Renwick.

The Committee have examined the plan proposed by Mr. Renwick, with all the attention which the importance of the subject, and the interest which it has excited, most justly required.

The expense of constructing locks on canals, the *difficulty*, and sometimes the *impossibility*, of supplying them with water, and the *delay* which always occurs in passing through them, have induced ingenious individuals, both in Europe and the United States, to suggest various substitutes, by which these difficulties might be lessened, although they could not be entirely removed.

The variety of these inventions has been as remarkable as their projectors have been numerous. A comparison, or even a description of their plans, could be comprised only in a volume; and our present limits will permit us only briefly to mention one or two which are analogous, in some of their features, to the project at present under our consideration. We, therefore, beg leave to refer you to those works in which the plans of the following individuals, are described: Messrs. Anderson, Bossut, Brindley, Bridge, Chapman, Dukart, Forey, Fulton, Fussell, Gauthey, Green, Leach, Long, Luke, Pickering, Reynolds, Rowland, Salmon, Solages, Sothern, Weldon and White. Many of these plans have been practically tested; several have been attended with success; others with partial, or complete failure; and, of the remainder, some, although plausible in theory, have never been subjected to the ordeal of trial, in consequence of the indolence, or inability, of their projectors, or from the want of confidence in the public, respecting the practicability of the inventions.

The majority of these descriptions refer to perpendicular lifts, to alterations in the plans of locks, or to inclined planes. To the latter only, of these plans, we propose now to direct your attention. A great variety of these substitutes for locks, has been constructed in Europe, and two have been attempted in this country, one at Hadley and one on the Morris Canal; the latter, intended for boats of twenty-five tons; the majority of the former, for vessels of less burthen. The most important of these substitutes, exists in full and successful operation, on the canal of the duke of Bridgewater, at Worsley; the inclined plane is 453 feet in length, and the perpendicular height 106½ feet, and the inclination about one foot in four. The boats are placed on cradles; the total weight of both boats and cradles is forty-two tons. The effect is produced by the descent of the laden boats elevating on the plane, those which are empty, through the medium of a connecting cable, revolving on a drum. The boats are supported on the cradle during the operation; and, hence, this plan is not adapted for boats of large dimensions, which, if constructed in the usual manner, require the equal support of water to preserve them from injury, resulting from the strains, and concussions, to which they might otherwise be subjected.

The methods proposed by William Chapman, and, more particularly, the plan described in the patent of James Fussell, (see the Repertory of arts, vol. xi, page 12,) obviate this difficulty. In this, the boat is floated from the canal into a caisson or moveable lock, which is balanced by another caisson, in which a boat may also be placed; these are connected by means of chains, revolving on drums, placed at the extremity of the inclined planes or rail-ways, which are also double, and extend from the lower to the upper level of the canal. The descent of one of these moveable locks, in which the boat continues to float, necessarily occasions the ascent of the other. The power requisite for this purpose, is extremely trifling; for the friction of the wheels of the caisson on the rail-way, and of the gudgeons and chains, is the only resistance which it is necessary to overcome.

The foregoing plan, in all its leading features, is extremely similar to that of Mr. Renwick, which we are now about to investigate. We will first proceed to describe the ingenious plan of the latter gentleman, which appears to us to be superior to every method which we have heretofore examined; to be perfectly practicable, and to possess many decided advantages over locks, and other devices, for overcoming elevations on canals. It is far less expensive, in construction, than locks, although it will be rather more expensive to maintain in repair; but this item of expenditure will be trifling, if we consider the great reduction in the expense which will result from the diminished number of superintendents which will be required. It requires a very small quantity of water to effect the transit of the boats, and one *remarkable* property of this plan, which we *particularly* submit to your attention, is, that *if the descending tonnage be one third greater than the ascending tonnage*, (and the proportion in this country has heretofore been much greater,) not only is *no water wasted*, by the transit of boats, but water will be actually *raised from the lower to the upper level* of the canal, even if the leakage from the gates and locks be considered: to accomplish this object, however, particular attention must be paid to the proper construction of the apparatus. This circumstance renders this plan of the greatest importance, particularly in the undulating. or mountainous, portions of the United States; for boats can be transferred, by means of this apparatus, from one level of a canal to another, with much greater certainty, rapidity, and economy, than by any other known method. We will not trespass on your time by dilating on, the consequences of these highly important facts.

We will observe that no apprehension need be entertained respecting the perfect practicability of this plan. Many of its main features, have been practically tested in Europe; even the details have been separately subjected to experiment, but the happy combination of them, into one apparatus, was, for the first time, effected by the ingenious James Fussell, of England, (see vol. xi, page 12, Repertory of Arts, for a description of his patent.) The original project of this individual, has been slightly modified, and improved, by Mr. Renwick, who has, however, *added one essentially novel, and highly important improvement* to Mr. Fussell's ingenious plan, viz. the substitution of *two endless* chains, in place of *one single* chain; and a *new arrangement of the gearing of the drums, over which these chains revolve.* In this alteration, the merit, and the originality, of Mr. Renwick's plan consist; it cannot be doubted that this will materially increase the safety, and convenience, of managing the apparatus.

We do not, however, suppose that the additional chain, will assist *equally* with the first, in supporting the weight, although it may, occasionally, support the whole, in case of accident to the first chain; and will frequently support a portion of the load, particularly if the line of the rail-way be curved laterally. The chains will, also, be advantageous in preserving an equable motion in the locks, which travel on the rail-way, or inclined plane.

We will now insert Mr. Renwick's description of his plan, and the opinions held in relation to it, by some of the most eminent engineers in the United States. We have every reason to believe that the original plan of Fussel, which by the *important improvements* of Mr.

Renwick, has been rendered practicable, was entirely unknown to Mr. R. and to the United States Engineers, *at the time when the following reports* were written. In the letter of this gentleman to the committee, which is attached to this report, the claims of Mr. Fussel, to merit and originality, are contrasted with his own in a manner at once discriminating, candid, and ingenuous. The great similarity, therefore, of his plan, to that of the original inventor, Mr. Fussell, may be adduced as one of those coincidences in inventions, which men of genius, have, unknown to each other, frequently exhibited.

JAMES RENWICK'S DESCRIPTION OF HIS INCLINED PLANE.

I should propose to substitute two moveable locks, or vessels of wood, mounted upon triangular cheeks, in such a manner as to remain constantly horizontal, and moving on truck wheels, upon the iron rail-way. If the chains, suspending these, be so connected, that one shall be drawn up, by the descent of the other, the discharge of a small quantity of water from either, will set the apparatus in motion.

A basin, sixty feet in length, three feet in depth, and nine in width, will contain 45 tons of water, and the basin, with its carriage, wheels, &c. may probably weigh fifteen tons more; in all, sixty tons. If the number of truck wheels be eight, and one fourth be suspended by the chains, each will have five and two-third tons to support, and the weight will be distributed over sixty feet of the inclined plane. Axles of iron, to support this weight, need not be of any very great size. It may be inferred, from the experiments of Banks, that a bar of cast iron, an inch square, and supported by props distant one foot from each other, will support a strain of a ton weight; and an axle of three and one sixth inches in diameter, seven and a half tons. But the strength of good wrought iron, is, by the experiments of Muschenbrock, double that of cast iron: axles of wrought iron, of the above diameter, will, therefore, be amply sufficient.

In order to support the locks, chain cables, which are now manufactured at Dover, may be employed in lieu of those of hemp, which were used by the duke of Bridgewater. The weight of each basin and its appendages, being taken at sixty tons, forty-five will be supported by its pressure upon the inclined plane, and fifteen will remain to press upon the chains. Chain cables, made of inch iron, are subjected, at Dover, to a proof of eighteen tons. One of these may, therefore, be relied upon as a support; but if two be employed, the apparatus may be considered as beyond accident; for should one of the chains break, the other will support the load during the transit, while the precaution of having the chain cable made in lengths, and spare parts constantly at hand, will restore it, at once, to its original situation, before it can be exposed to any new strain.

As the motion would be accelerated, in some degree, by the unwinding of a great length of chain,* stoppers, similar to those employed with the chain cables on shipboard, should be provided; and, as by means of them, any resistance, not capable of breaking the chains, may be overcome, the motion may be regulated, at will, to any degree of velocity. These stoppers will also be of use in another case that will be hereafter mentioned, and will serve to retain the car in close contact with the gates.

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* As *endless* chains will be employed in this apparatus, the acceleration will be occasioned by the *momentum* of the locks, and not from any *additional weight of the chains*, in descending; for this weight is a *constant quantity*, under all circumstances.—*Note of the Committee.*

Where a cavity of fifteen feet in depth, can be excavated beneath the level of the bottom of the lower portion of the canals, and the water drained from it, either entirely, or in a great degree, the water of the lower level may be shut out by gates, similar to those that terminate the upper extremity of the inclined plane. In this event, the chains may be wound around a single horizontal shaft: those attached to one moveable lock, in one direction, and those attached to the other, in the opposite; the uncoiling of one pair, will, in that case, be accompanied by an equal involution of the other pair. But a position, affording this facility, will probably but seldom occur, and, therefore, an expedient of less simplicity, but of equal practicability, must be adopted. Each pair of chains must be wound around a separate shaft, and these must be so arranged, that they may act upon one another by the intervention of spur wheels; if one of the shafts have two wheels firmly fastened to it, with the number of teeth in proportion to each other, similar to that which exists between the total length of the inclined plane, and that portion of it which is above the surface of the water, in the lower reach of the canal, while two similar wheels are moveable, by means of a lever, upon the axle of the other shaft, in such a way that either may be connected at pleasure, with a wheel of a different number of teeth attached to the first shaft, it is obvious that, by such means, a velocity of motion may be given to the ascending lock, that shall draw it through the whole height of the inclined plane, during the time that the descending lock proceeds no lower than to touch the surface of the water, while the excess of water, in the descending lock, above the joint weight of a boat and its cargo, will furnish a sufficient moving power, except when the plane is very short. The stoppers that we have already mentioned, being now applied to the chains, the wheels may be thrown out of gear, and then by relaxing the pressure of the stopper on the descending lock, it may be permitted to sink gently into the cavity beneath the bottom of the lower level, into which the inclined plane must be extended so far as to permit the surface of the water, in the moveable lock, to become the same with that of the lower reach of the canal.

As the general aspect of the country presents every chance of finding favourable localities,* the inclined plane, itself, with its rail-ways, will be attended with but little difficulty. Supposing the ground to present the usual surface of boulders and gravel, this must be first smoothed to the proper angle, and excavated to a suitable depth, to admit the superstructure. Upon the ground thus smoothed and sloped, the foundation may be laid of fragments of stone and gravel, to the depth of eighteen inches; and it should be exposed, for a winter, to the effects of frost, in order that it may settle. Upon this foundation are to be laid, at intervals of three feet, from centre to centre, blocks of stone, to support the rail-way: these should be, at least, eighteen inches in thickness, and weigh not less than 2 cwt. each. The plane of their upper surfaces may be brought nearly to the proper slope of wedges of stone, and must then be finished, and opened, by the chisel, to admit the rails. The intervals of the stones are then to be filled up with lesser stones and chips, and the whole smoothed into one regular plane surface; so that the rails may bear uniformly and equally in every part. The rails cast into the usual lengths of three feet, are to be fastened to the stones, laid and chiselled for the purpose, in the manner of a common rail-way.

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* Mr. Renwick here alludes to the country traversed by the Morris Canal.—*Note of the Committee.*

Should, however, any doubt arise, although I entertain none, of the sufficiency of this method, which is the usual European mode of laying rail-ways, a small additional expense will place the structure beyond the reach of suspicion; let each of the outer rails be laid upon a firm wall of masonry, and a similar, but thicker wall, laid to support the two inner rails. The intervening space may be filled with chip stone, or may have a wooden channel laid in, to carry water to the lower levels.

Estimate of the cost of an inclined plane of 100 *feet descent.*

Excavation 2000 yards, at 12½ cents,	$250 00
———— 1500 ,, ,, 25 ,,	375 00
Stone and gravel 1100 ,, ,, 37½ ,,	412 50
Stone 2200 ,, ,, 1 25 ,,	2750 00
Chiselling and drilling 626 stones,	313 00
Wall at foot of plane, 800 perch, at $1 50,	1200 00
Walls at head of plane, 184 ,, ,, 2 50,	460 00
Timber 1200 feet, at 6 cents,	72 00
Plank 2000 ,, ,, 3 ,,	60 00
Laying foundation,	132 00
	$6024 50
Two gates at head of plane,	150 00
Two moveable locks, plank, timber, and carpenter's work	600 00
	$6774 50

Iron Work.

Rail way, 640 yards, 1 cwt. per yard, 32 tons, at 80 each,	$2560 00
Fitting and laying, do.	440 00
Chain cables, 4 of 80 fathoms each, at 56 pounds per fathom, 8 tons, at $200 per ton,	1600 00
Cast iron wheels, 16 of 1 cwt. each, at $80 per ton,	64 00
Wrought iron axles, 8, 2000 lbs. at 8 cents per lb.	160 00
Spur wheels, 4, 8 cwt. at $6,	48 00
Gudgeons and sockets, $50—fitting, $150,	200 00
	$5072 00
Two shafts,	50 00
	$11,896 50

Brought over,	$11,896 50
Should the rails be supported on walls of masonry, the estimate will be,	
1400 perch of masonry, at $2 50,	$3500 00
1370 cubic yards of chip stone, at $1 25,	1712 50
Instead of 2200 cubic yards, at $1 25,	5212 50
	2750 00
Making an addition of	2462 50
Total,	$14,359 00

Say $150 per foot of descent.

EXTRACT FROM THE OPINION OF BENJAMIN WRIGHT, CIVIL ENGINEER.

"The great elevation above tide-water, which it is proposed to carry this canal,* would at first view, appear a heavy item of expense, provided this elevation was to be overcome by locks exclusively, built after the manner of those on the Erie Canal. Happily, however, James Renwick, Esq. of Columbia College, has projected, and nearly matured, a plan of rising, or falling, from one level to another, by means of inclined planes, to be erected at all eligible and favourable positions, to overcome 1400 feet of ascent and descent, and the remainder to be conquered by locks of various lifts, to be constructed of hammered stone, and made upon the most economical plan, and durable construction. Mr. Renwick has explained to me the plan, and operation of his inclined plane, in his report on the subject, and in our several interviews, and has satisfied me of the practicability and utility of adopting it, as a great saving in expense, in water, and in time, upon the proposed canal, and I feel the greatest confidence in its successful operation."

EXTRACT FROM THE OPINION OF GEN. JOSEPH G. SWIFT, OF NEW YORK.

"Much time has been occupied in devising a plan to pass the highlands; for the hill opposed appalling difficulties to mere lock navigation. Your invention of a new adaptation of the inclined plane, has, in my opinion, given means to obviate this difficulty. I am glad to learn that Gen. Barnard, and Col. Totten, coincide with me in this opinion; I have examined the subject with some care, and am entirely satisfied that the planes can be easily constructed, and that they would be safe, and sure."

(TO BE CONTINUED.)

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* The Morris Canal, New Jersey.

Abstract of the report of the Committee on Premiums and Exhibition, on the subject of the third annual exhibition, and of the premiums awarded.

The third annual exhibition of American Manufactures, was held at the Masonic Hall, on the 3d, 4th, 5th, and 6th October.

Of the sixty-three premiums offered by the Institute, twenty-four were claimed, and fourteen awarded to successful competitors.

The committee regret that the number of premiums claimed was so limited, but express their satisfaction at the rapid advancement our manufactures have made towards perfection, within the last year, of which, the recent display afforded abundant proof.

Among the various branches which might be selected in support of their observation, they especially notice the cut glass, cabinet furniture, musical instruments, mantles, grates, lace, straw bonnets, leather, and particularly a large collection of china, from Jersey City. Although they withhold their unqualified praise, from this collection, they congratulate their fellow citizens on the evidence now presented, that America is able to supply herself with this important product, and to look forward to a day, not very far distant, when this country will be no longer tributary to foreign manufacturers, for the supply of these articles.

As it was altogether impossible for the committee to enter into a detail of all the numerous specimens exhibited, they reserve this for a future report, and content themselves with an enumeration of those to which the premiums are due, and which they have thought worthy of particular commendation.

The premium to the maker of the best specimen of soft iron castings, fit for small machinery, is awarded to Dean Walker, Savage Factory, near Baltimore, for a box of machine castings, which were, in the opinion of the judges, superior to any they had ever seen:—The silver medal.

To the maker of the best constructed stove, or grate, for burning anthracite, for domestic purposes, and, which will unite convenience with economy, is awarded to Mr. Joseph Page, Philadelphia: his stove is simple in its construction, and contains all the required conveniences:—The silver medal.

To the maker of the best flint glass-ware: awarded to J. L. Gilleland & Co. of Brooklyn, New York. This premium was offered for the quality of the material, and the form of the article, and not for the cutting; and the judges report, that among all the specimens made by these gentlemen, they could not perceive one bad piece:—The silver medal.

To the makers of the best red earthenware: awarded to Thomas Haig, Northern Liberty Pottery, Philadelphia. The specimens exhibited much improvement in the art:—The bronzed medal.

To the maker of the best china, from American materials; awarded to the New Jersey Porcelain and Earthenware Company. The makers are entitled, by the proposal, to the bronzed medal; but, in consideration of the great importance of the object, the committee have awarded—The silver medal.

To the manufacturer of the best piece of black broad cloth, awarded to J. M. Robbins, Watertown, Mass.:—The silver medal.

For the best specimen of skirting leather, tanned and dressed in Pennsylvania, awarded for three bundles manufactured by Wm. Linvill, Lancaster county, Penn.:—The silver medal.

To the maker of the best japanned leather, made in the United States, awarded to Street & Foering, Philad.:—The bronzed medal.

For the best cabinet secretary and book-case, awarded to Charles H. White, Philad.:—The silver medal.

To the manufacturer of the best white lead, 50 lbs. exhibited, assurance given that 20 tons of the same quality and price will be furnished, awarded to Samuel R. Wood, Norristown, Penn.:—The silver medal, when the conditions of the premium are fulfilled.

For the best specimen of lithography, executed in the United States, awarded to W. & J. Pendleton, Boston:—The silver medal.

To the maker of the best pair of marble mantles, of Pennsylvania marble, awarded to Lewis Stegagnini, Philadelphia, for a pair of double column mantles, Henderson's marble:—The silver medal.

To a pupil of the Drawing School, for the best specimen of drawing, awarded to Mr. Andrew Young, of Flat Rock, Pennsylvania, for four specimens of geometrical and perspective drawing, the result of one winter's study, at the school of the Institute:—The silver medal.

In accordance with the reservation of the right of awarding such premiums, or compliments, for articles not enumerated in their proposed list of premiums, as may, in the opinion of the committee, be deemed worthy of them, they have, with the advice of the judges, made the following awards.

To Professor James Renwick, of New York, for his improvements in the inclined plane:—The silver medal.

To Anthony G. Quervelle, Philad. for a mahogany sideboard, with white American marble cover:—The bronzed medal.

To John Steele, of Philadelphia, for two pieces of gingham:—The silver medal.

Striped and twilled goods were presented by Joseph Ripka, of Philadelphia, which were also very superior, and would have received an honorary medal, had he not been a member of the committee of judges.

To H. Whitaker, of Cedar Grove, near Philadelphia, for three pieces of bang up cords:—The silver medal. The judges report, that the novelty of this manufacture, and its excellence, entitle the manufacturer to the particular notice of the Institute.

The committee award *honorary mention*, to the makers of the following specimens.

To John Ashburner & Son, of Philadelphia, for thirty sides of slaughter sole leather, which is uncommonly good, and entitled to special notice.

To Cyrus Jacobs, of Lancaster county, Pennsylvania, for five bars of iron, all remarkably well drawn, and of excellent quality. That marked Pool forge, was the finest.

To F. W. Widmann, of Philadelphia, for two swords, manufactured by him. They reflect high credit on the maker.

To Lloyd & Sons, of Philadelphia, for a coal grate.

To Samuel P. Griffitts, of Philadelphia, for a roll of adhesive plaister, on muslin. This plaister was spread by Mr. Griffitts, on machinery of his own invention. It is equal to the imported, and deserves to be introduced into general use.

To McLord & Shiner, Philadelphia; Jackson and Baggot, New York; the New England Glass Company; Bakewell, Page & Bakewell, Pittsburg; and G. Dummer & Co. Jersey City, for the splendid collection of cut glass. The judges report that these articles, are so well, and so extensivly made, as to prove, beyond all question, that this country need not remain tributary to foreign manufacturers; and they state, without hesitation, that there was not an article exhibited, that would not do credit to any foreign establishment. The premium being offered for the glass only, they were relieved from the delicate and difficult task of discrimination.

To George Armitage, Philadelphia, for five pair of plated mugs, equal in taste of design, and in workmanship, to the best imported ware. These are the first articles of the kind made in the United States, that ever came to the knowledge of the judges.

To J. Graham, Philadelphia, for a secretary. This is an excellent sample of well finished work.

To C. A. Morris, York, Penn. for a piece of Venetian carpet, made in the family of Mr. Morris.

To J. M'Cauley, Philadelphia, for a painted floor cloth, 60 feet long, and 21 in width; also, five pieces of patent oil cloth. The specimens presented, were equal, if not superior, to any imported.

To Blanchard, Haley & Beaty; and A. Y. Humphreys, for specimens of paper hanging. The manufacture of paper hanging, now rivals any foreign competitors. The samples produced, were highly creditable to the makers.

To Christian Gobrecht, for the medal dies of the Institute, cut by him. The judges have recommended these dies as deserving special commendation. The head of Franklin is correctly drawn, and well chiselled, the forehead, in particular remarkable for its truth, and neatness of execution, and the expression of the countenance well preserved.

To Thomas Harrison, Philadelphia county, for a box of rose pink, of a very superior quality; to M'Kim, Sims & Co. Baltimore, for Prussian blue, the best exhibited; and to J. Boston, Philadelphia, for a very superior sample of lake carmine.

To Jos. Saxton, of Philad. for his compensating pendulum. This ingenious contrivance consists of a rod of steel enclosed in two tubes, one of steel, the other of zinc, so arranged that while the expansion of the steel tends to lengthen the pendulum, the zinc shortens it, and these two effects exactly counterbalance each other. The arrangement of this tubular pendulum, and the method of adjustment, are new, and entitle Mr. Saxton to honorary mention.

To Peter Kennedy, Philadelphia, for a door lock.

To Mason and Baldwin, Philadelphia, for a slide rest, and an engraved copper cylinder, for calico printing, both made by them.

To John Bancroft, Delaware county, for four pieces of flannel.

To Kershaw & Dean, Pennsylvania, for two blankets. These blankets were of a very superior quality, and the committee would have gladly awarded the premium, had the conditions been adhered to: one dozen pair should have been exhibited.

To Daniel Bulkley, of Hampton, Conn. and to J. Fitch, ———, Conn. for sewing silk; a very superior article, not surpassed in quality, or colours, by the best Italian silk.

To J. Read, of New York, for silk vesting and ribands.

To Christian Cornelius, of Philadelphia, for a large chandelier. A beautiful specimen of workmanship, entitled to great praise, particularly for the fine colour of the lacker.

To John Struthers, for a mantle of Italian marble. This beautiful specimen of work, could not come into competition, by the terms of the proposal, as the material was not Pennsylvanian; it reflects the highest credit on the maker, for taste of design, and excellence of workmanship.

The highest praise is also due to Messrs. Loud & Brothers, of Philadelphia, and Dubois & Stodart, of New York, for their upright pianos, the latter made by R. & Wm. Nunns. The committee agree that these instruments were decidedly the best at the exhibition, but are divided in their judgment as to which of the two, ought to have the preference. The tone of each was very pleasing, distinct, and full.

To Hannah Smith, teacher of the Walnut street school, Philadelphia, and Eliza Bennet, of Massachusetts, for a straw bonnet each; pronounced very superior, and deserving particular notice. Also, to Joseph Belcher, of Berkshire, Tioga county, New York, for a Leghorn bonnet, price $25; in fineness of plait and sewing, and in richness of colour, rarely surpassed by imported bonnets, at any price.

To J. L. Sullivan and David Clarke, for patent bound blank books, well made, handsome, and durable.

To Eldridge & Brick, for very superior waxed calf skins.

To A. Atkinson, for three saddles, very splendid and superior articles.

To Henry Huffman, foreman of Henry Apple, for a 66 gallon cask.

The aquatint, of Doughty's picture of Fair Mount Water-works; by Hill, the likeness of Chief Justice Tilghman, by Bridport, and the plates for Carey & Lea's Souvenir, by Ellis, Longacre, Kearney, Maverick and Childs, are all executed in a manner highly creditable to the artists. The presentation plate to the same work, exhibits the ingenuity of Mr. Gobrecht in a department new in this country, and which will be an appropriate ornament.

Gilt buttons from the manufactories of A. Goodyear & Son; Leavenworth, Hayden & Scovill; Lewis, Grilly & Lewis, of Waterbury, Conn.; R. Robinson & Son, of Atleboro', Mass. and George Armitage, of Philadelphia, deserve, from their excellence, to supersede any that are imported. The improvement in this article, within the last year, is particularly noticed.

The committee close their examination with making special mention of various other articles, which they deem justly worthy of notice, and which we very unwillingly omit, from an apprehension that the whole list might be thought to occupy too large a portion of the Journal.

Notwithstanding the immense crowd of visiters that thronged the Hall, during the first three days, which was computed by actual count, at different times, to be about thirty four thousand, not a single article was missed, and, it is believed, nothing materially injured. The committee have great satisfaction in being able to announce this fact, both for the credit of the city, and to dispel a report which had arisen, that some valuable articles had been clandestinely removed.

QUARTERLY MEETING OF THE FRANKLIN INSTITUTE.

At a Quarterly meeting of the Franklin Institute, held at the Hall, October 16th, 1826, James M'Alpin, was appointed President *pro tem.* and Dr. Thomas P. Jones, Secretary *pro tem.*

The eleventh Quarterly report of the Board of Managers was read, accepted, and ordered to be printed.

On motion resolved,—That the thanks of the Institute be presented, and they are hereby presented, to the Board of Managers, for the faithful and able manner in which they have discharged their duties; and particularly for the zeal evinced by them in the successful establishment of the High School.

Resolved,—That the Institute have heard with peculiar pleasure, of the donation by our fellow citizen, Dr. John Redman Coxe, of an electrical machine which formerly belonged to the immortal Franklin;—a donation which is the more valuable, as it may tend to cherish by the presence of a sensible memorial, a vivid recollection, not only of the general scientific merits, but also of some of the peculiar attainments, of that great philosopher.

Resolved,—That General Stephen Duncan, Walter R. Johnson, and George W. Smith, be appointed a Committee, to wait on Dr. Coxe, with a copy of the foregoing resolution.

Resolved,—That the thanks of the Institute be presented to Turner Camac, Esq. for his liberality in presenting a copy of that rare and valuable work, Langley's Architecture, and that the same committee be requested to carry this resolution into effect.

Resolved,—That the Society have seen with regret, that the Franklin Journal, published under the auspices of the Institute, has not been supported by its members, and by the public, with that liberality to which it is entitled, by its pre-eminent usefulness, and the science and zeal displayed by its Editor;

Therefore resolved,—That this meeting will use every endeavour to increase the circulation of a work, the discontinuance of which, would injure the character of Philadelphia.

Resolved,—That this meeting recommend to the Board of Managers, of the Institute, to consider the propriety of holding a Quarterly meeting of the Society, immediately after the delivery of the medals.

James M'Alpin, *President pro tem.*

Thomas P. Jones, *Secretary pro tem.*

Eleventh Quarterly Report of the Board of Managers of the Institute.

To the Franklin Institute of the State of Pennsylvania, the Board of Managers present their eleventh Quarterly Report.—The Board of Managers in their last Quarterly Report to the Institute, noticed the arrangements which had been made, for carrying into effect, the resolution for the establishment of a High School, to be under the patronage of, and attached to the Institute. This School was opened at the period contemplated, and under auspices the most gratifying to its founders. Within a few days from its commencement, upwards of three hundred pupils were admitted, and could a greater number have been accommodated, they might have been obtained. From the decided approbation of the plan of the School, which the public has thus distinctly manifested, and from the manner in which this department has been hitherto conducted, the Board feel perfectly assured of the utility, and the permanence of the establishment. The School has been in operation for so short a period, that no official report, respecting its progress, has yet been made by the Committee of Instruction; but, it is known to be under contemplation, to extend its benefits to a greater number of pupils, when suitable premises can be procured. This, when accomplished, will leave that part of the Hall now occupied by the School, to be appropriated to the uses for which it was originally intended.

The Evening Schools for Drawing, and for Mathematics, have recommenced, under the same able instructors by whom they have been heretofore conducted.

Some unexpected delay has taken place in the finishing of the new Hall; the Board, however, have adopted such measures, as will insure its completion, and prevent all the inconvenience which this delay might otherwise have occasioned.

The Hall will be opened, preparatory to the delivery of the courses of lectures, for the ensuing winter, on the 6th of November, when an address will be delivered there by professor Patterson. Professor Jones will commence his course of lectures, on practical Mechanics, on the 7th of the same month, and will continue to lecture on every succeeding Tuesday. Dr. Franklin Bache, has been appointed to lecture upon Chemistry, as applied to the arts, in the place of professor Keating, who is absent; this course will be delivered on Thursdays, commencing on the 9th of the month. Saturday evenings, have been reserved for volunteer lectures.—Dr. Godman, the professor of Natural History, has obtained leave of absence for the season.

The Annual Exhibition, commenced on the 3d inst. at the Masonic Hall, and was continued for four days. The reports of the respective committees, appointed to judge of the articles exhibited, will be published; the Board, however, deem it proper to remark, that the beauty and excellence of many of the manufactures, were such, as not only to produce general satisfaction, but greatly to surpass the expectations of the most sanguine. The intense interest excited in the public mind, was strikingly manifested by the crowd of visitants which continued during the whole period of the exhibition, and, also from the opinions expressed by those who are competent judges. The number of inferior articles of manufacture, was not so large as at the preceding exhibition, but the great progress which had been made during the last year, was strikingly exemplified in the general superiority of the fabrics, and in the production of new articles of manufacture.

The arduous duties devolving upon the committee of premiums and exhibitions, the committee of arrangement, and those appointed as judges of the various articles, were performed with a degree of zeal, and ability, which justly entitle the members of them, to the gratitude of the Institute.

The medals, which have been awarded, were delivered to the successful competitors, on the 14th instant. In several instances, in which the excellence of the manufactures, would have entitled them to a premium, it was necessarily withheld, in consequence of the conditions not having been complied with, on the part of the manufacturer.

There has been a considerable accession of new members since the last report; and the approaching season, for the delivery of the lectures, will undoubtedly add to the number. The library, the cabinet of Minerals, and the apparatus, have received some additions; in the latter, we may particularly mention a donation from Dr. John Redman Coxe, of the Electrifying machine, upon which the original experiments of Dr. Franklin were performed; and, in the former, Langley's Architecture, in large folio, with 494 plates, presented by Turner Camac, Esq.

Measures have been taken, which will probably eventuate in the annexing a very valuable cabinet of Minerals, to those now in our possession.

The Franklin Journal, conducted by the Professor of Mechanics, continues to sustain its reputation; but, the Board regret to learn, that it has not received that support from the members of the Institute, which was anticipated, and which the work so justly merits.

With the termination of the year, for which the Board was elected, a detailed statement of the fiscal concerns of the Institute, will be exhibited. Some temporary difficulty will be experienced, from the diminution of the receipts, consequent upon the alteration of the time for receiving the annual payments from members, as it is upon this fund, that we principally depend for meeting our current expenses. This difficulty will be greatly lessened, if not altogether removed, should those members, who at present are in arrears, make immediate payment.

All which is respectfully submitted,
By order of the Board of Managers.
WILLIAM MILLER, *Chairman pro tem.*
JOHN R. WARDER, *Clerk.*
Philadelphia, October 19th, 1826.

MECHANICAL JURISPRUDENCE, No. X.

BY PETER A. BROWNE, ESQ.

On the Law of Patents for New and Useful Inventions.

Having, in the last essay, treated on the first qualification of a valid patent, I now come to the second; that of being *new*. The law not only requires that the patentee shall be the inventor, but, in England, he must be the FIRST and TRUE inventor; in the United States, he must be the TRUE and ORIGINAL inventor. The laws of both countries admit, what experience teaches, that there may be two, or more, inventors or discoverers of the same thing: and, as by the laws of both the countries, there can be but *one* valid patent for an invention or discovery, the question often occurs, which among them is the *first* and *true*, or the *true* and *original* inventor.

Among inventors, who have reduced their inventions to practice, he who is *first in point of time*, is preferred by the law. This was decided in the case of Lewell *v.* Lewis, 1 Mason's Rep. 182. In the year 1813, Jacob Perkins obtained a patent for a new and useful invention, in the construction of pumps, and assigned his interest to the plaintiff. James Baker, in 1817, obtained a similar patent, which was assigned to the defendant.

Judge Story, in his charge, said, "If they (the machines) are the same invention, then Mr. Perkins, being clearly the *first* inventor, is entitled exclusively to the patent right, although Mr. Baker may have been also an *original* inventor, for the law gives the right, among inventors, to him, who is the first in time."

It is worthy of a passing observation, that the above preference is not founded on the construction of the word *original* in the act of congress, which is substituted for the word "first," in the British statutes, since Judge Story speaks of both being *original* inventors.* But, the *first* inventor, in point of time, must, in order to entitle himself to a preference, reduce his invention to practice; for it is not he who confines his invention to his closet, but he who reduces it to practice; who takes out a patent, and makes it public, within a reasonable time, that the law prefers.

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* If the above is, as it is supposed to be, a correct statement of the law, the person, who has discovered a new and useful invention, must not be satisfied with the consciousness of having been the original *bona fide* discoverer, he must institute the enquiry, whether some other more fortunate individual may not, at an anterior time, have made a similar discovery.

One Hall discovered a new method of making the object glasses of refracting telescopes, by compounding fluids of different refractive qualities, but he did not make his discovery public: one Dolland having made the same discovery, took out a patent, and the question was, whether Hall, or Dolland, was the *first* and *true inventor*, within the meaning of the British statute; and it was decided in favour of the latter. This case is mentioned by Buller J. in pages 470 and 487 of 2d Hen. Blackstone's Reports.

The same point came before the Circuit Court of the United States, for the first circuit, in 1813. Woodcock sued Parker, for a breach of a patent, for splitting leather. The plaintiff's patent was dated the 8th May, 1809; the defendant claimed, under another, Parker, whose patent was dated the 9th July, 1808; the question was, whether Woodcock, or Parker, was the *first* inventor. Story J. observed, that the first inventor is entitled to the benefit of his invention, *if he reduce it to practice, and obtain a patent therefor*, and a subsequent inventor cannot, by obtaining a patent therefor, oust the first inventor of his right, or maintain an action against him, for the use of his own invention. See 1. Gallison's Reports, 438.

It is a well settled principle of law, that if the inventor of a machine, &c. absolutely abandons his right to take a patent, it becomes public property.

In the case of Evans *v.* Eaton, 1st Peter's C. C. Rep. 348; it appeared, that the plaintiff sued for a violation of his patent right to an improvement in the art of manufacturing flour, &c. by means of certain machinery, among which was a hopperboy. The defendant produced several witnesses, who described a machine, called Stouffer's machine, or hopperboy, similar to the plaintiff's, which had been in use in many mills from the year 1764.

Judge Washington observed, "The last point is, that Stouffer's invention was abandoned, and consequently might be appropriated by the plaintiff. The principle may be admitted, but not the conclusion. If Stouffer was the original inventor of the hopperboy, and chose not to obtain a patent for it, *it became public property by his abandonment*. He could maintain no action against any person for using it, nor could any other person obtain a patent for it, because he would not be the original inventor.

In like manner, in the case of Whitemore *v.* Cutter, 1 Gallison's Reports, 478, Judge Story declares, that if the original inventor of a machine, &c. suffers it to be freely and fully used by the public at large, for such a length of time, that this devotion to the public use can be fairly inferred, he cannot afterwards resume the invention, and take out a patent.

What circumstances will be evidence of an abandonment, and what length of time the inventor may allow to elapse, without taking out a patent, and without losing his right, are questions not so easily decided, as will appear from the following cases.

A case of Evans v. Weiss, is mentioned in Fessenden, on Patents, page 52. The plaintiff was the inventor of an improvement in the manufacture of flour, and the patent-right to the same, theretofore obtained, having been adjudged void, and the time for which the said patent was granted, having, also, run out, an act of Congress was made for the plaintiff's relief; notice of which was given to the defendant. During the continuance of the former patent, the defendant purchased of the plaintiff, a right to use the improvement, at his mill, for one wheel and pair of stones; but, prior to the passing of the act of Congress, he had applied and used the same, for two wheels, and two pair of stones. The questions submitted, were, whether the defendant was liable for damages, for the use of the said improvements, in application to this second wheel and pair of stones, after the passing of the act of Congress; and, if so, whether he was liable before notice from the plaintiff.

In delivering the opinion of the Court, Judge Washington is represented to have uttered the following sentiments, viz. "It must be confessed, that cases of great hardship may occur, if, after a man shall have gone to the expense of erecting a machine, for which the inventor has not then, and never may obtain a patent, he shall be prevented from using it, by the grant of a subsequent patent, and its relation back to the patentee's prior invention. But the law, in this case, cannot be termed *ex post facto*, or even retrospective, in its operation; because the general law declares, beforehand, that the right to the patent belongs to him, who is the first inventor, *even before the patent is granted;* and, therefore, any person, who, knowing that another is the first inventor, yet doubting whether that other will ever apply for a patent, proceeds to construct a machine, of which it may afterwards appear, that he is not the first inventor, acts at his peril, and, with the full knowledge of the law, that by relation back to the first invention, a subsequent patent may cut him out of the machine thus erected.

"Not only may individuals be injured by a liberal construction of the words in the law, but, the public may suffer, if an obstinate, or negligent, inventor, should decline obtaining a patent, and, at the same time, keep others at arms length, so as to prevent them from profiting by the invention, for a length of time, during which, the fourteen years *are not running on*. But, these hardships must rest with Congress to correct. It is beyond our power to apply a remedy."

And it would seem, from the case of Pettibone v. Derringer, which was tried before Justice Washington, in May, 1818, that he did not *then*, consider this point as entirely settled. It was an action brought for the recovery of damages, for an infringement of a patent, for a new and useful improvement in musket, pistol, and rifle barrels, by an auger, called the spiral groove, or twisted screw auger. The plaintiff gave in evidence, a letter from himself to the Secretary of State, dated 21st January, 1799, containing a specification of an improvement in boring muskets, and agreeing, in every material circumstance, with that annexed to his present patent, except that he states the augur used, to be one called the nut bit, invented by M'Cormick. In this letter, he claims to be the inventor of the improvement, and claims a patent for the same. He, also, gave in evidence, a similar application to the Secretary of State, dated 12th August, 1799, accompanied by a similar specification, except, that this speaks of, and describes, the twisted screw auger, as his invention. Both specifications are accompanied with the usual affidavit.

The tendency of the plaintiff's testimony, was to prove, that he was the first inventor of the twisted auger, for boring musket, pistol, and rifle barrels; that he was, also, the inventor of the mode of *drawing*, instead of *pushing*, the auger through the barrel, and of the application of the endless screw, to produce that effect; and, also, of the superiority of his invention, to the former modes of boring gun barrels.

The defendant examined a number of witnesses, to prove, that the plaintiff was not the inventor of the screw auger, nor of the mode of drawing the auger through the barrel, but that both had been invented, and used, before the plaintiff pretended to have invented either; and, also, that the difference between M'Cormick's auger, which the plaintiff acknowledged to have been used before January, 1799, and the screw auger, of which he claimed to be the inventor, in August, 1799, was not a difference in principle, but in form only. Also, that M'Cormick's auger was preferable to the plaintiff's, and was more generally in use, in the public manufactories of arms.

The counsel for the defendant argued, that the delay of the plaintiff, to secure his invention, (if he was the inventor,) from 1799, to 1814, was an abandonment of all benefits, and privileges, proceeding from it; and that, having thus avoided his right, he could not afterwards reclaim it.

Judge Washington, on this point, charged the Jury, as follows. "The defendant's counsel, have presented to the consideration of the Court, another ground of defence, which is equally new and embarrassing. It is, that although it appeared that the plaintiff was the first inventor of the improvement, which he claims, still, he ought to be considered as having abandoned it to the public, and, consequently to have lost his right to a subsequent exclusive appropriation of it. The ground upon which this argument rests, is an implied abandonment, or waiver, of the plaintiff's right, in declining to take out a patent until 1814, for a discovery, asserted to have been made in 1799. Whether such a waiver can, under any circumstances, be presumed, from the mere fact of the loss of time, between the discovery, and the date of the patent, is a question of great importance. If it cannot, then the law ought to provide for such a case, by limiting the legal effect of the discovery, either to the date of the patent, or to such prior period, as the legislature, in its wisdom, may think just. For if the patent, may relate back to the discovery, however remote, it is most obvious, that the inventor possesses to a certain degree, all the rights of a patentee, in addition to those rights, which are secured to him by the patent. For in the case of costly machinery, what man would venture to construct, and use it, without the permission of the inventor, and without purchasing from him that permission, if the inventor might, at any time afterwards, take out a patent, and forbid the subsequent use of it. Thus the inventor, may hold all the world at arms length, as long as he pleases, and enjoy, to a certain degree, the fruits of his discovery, during all that time, and finally secure the right in its full extent, for fourteen years more, by obtaining a patent."

In the case of Huntington *v.* Morris, M. S. Rep. of the C. C. U. S. for the Southern District of New York, Judge Thompson having decided, that the discovery should be unknown, and not used, as the invention of *any other than the patentee*, before the application for a patent, adds, "I am aware that evils might exist under this construction; expensive machines might be made before a patent should be taken out, and persons, who had innocently engaged in expenses in this way, stopped short; but, I incline to think, that, under such circumstances, a patent would not be permitted to operate to the prejudice of persons thus situated, on the principle, that innocent third persons should not be injured by relation back, so as to deprive them of a right, lawfully acquired; and, that if a person knowing of an invention, proceeds to put it in use, the inventor not having secured his right by patent, the latter ought not to be permitted to take away that which had been previously lawfully made. That no man should be permitted to lay by for years, and then take out a patent: but that if he was practising his invention, with a view of improving it, and thereby rendering a greater benefit to the public, before taking out a patent, that should not prejudice him."

Supposing lapse of time to be presumptive evidence of an abandonment, another question will occur, namely, what act of the inventor shall amount to a rebuttal of this presumption.

Judge Washington, in the case above cited, notices this question, in the following manner. "Another question in this case, and under this head, is, whether abandonment, if it can be presumed at all, is repelled by the circumstance of a claim to this discovery having been filed in the department of state, and subsequently renewed, in the way of continual claim? This was done by the present plaintiff, in 1799 and 1812. If it can, it must be admitted, that the inconveniences to the public, which are before pointed out, are not at all removed, or diminished, by such a course of proceeding. Upon these points, the court would not wish to express an opinion, unless it shall be insisted on by the counsel, on either side, and if it be, we shall not withhold it."*

Whether the party has abandoned, or not, is a question of intention, to be left to the jury.

Huntington *v.* Morris, M. S. C. C. N. Y. Rep. Judge Thompson. "It should always be a question submitted to a jury, what was the intent of the delay of the patent, and, whether allowing the invention to be used without a patent, should not be considered an abandonment, or a present of it, to the public."

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* I take the liberty here, of recommending to those who have made, or shall hereafter make, new and useful discoveries, to delay taking out their patents, no longer than shall be absolutely necessary to make those prudent enquiries which ought to precede every application for a patent. By so doing, they will avoid the risk of having their exclusive privilege called in question, on the ground of abandonment.

In an action for the violation of a patent, if the ground of defence be, that the plaintiff is not the original inventor, he must come to the court prepared to prove that fact. This was established in the case of Evans *v.* Kremer, 1. Peters' C. C. Rep. 215.

But slight proof is all that is required in the first instance. Turner *v.* Winter, 1. Term. Rep. 602.

FOR THE FRANKLIN JOURNAL.

On the employment of fatty substances, for impregnating stone and plaster, in order to render them water tight, and also for making damp places, dry and salubrious. Abstracted from a memoir, by Messrs. D'Arcet and Thenard, published in the Annales de Chemie, for May last.[*]

The observations which gave rise to this memoir, were commenced in 1813; at this period, Messrs. D'Arcet and Thenard were consulted, respecting a composition, with which it was contemplated to cover the cupola of the Church of St. Genevieve, in order to render it impervious to water. A little reflection convinced them, that the best mode, would be to fill the pores with some fatty matter, which might be liquified by heat, and which would be solid, when cold. This conviction was strengthened by the fact, that the ancients sometimes melted wax, upon walls which they intended to paint. It was concluded therefore, that a mixture of yellow wax, and linseed oil, rendered drying, by litharge, would answer the purpose. One part of wax, was melted in three parts of linseed oil, which had been boiled with one tenth of its weight of litharge. On taking a piece of the kind of stone of which the cupola was built, which appears to have been rather soft and porous, it was found to imbibe the mixture readily, when heated, and that when cooled, it had increased in solidity, and after a lapse of six weeks, or two months, it had attained a considerable degree of hardness.

The preceding trial having been made, it was determined to apply the composition to the cupola; this was effected by scraping off the materials, with which it had formerly been covered, so as to leave the stone perfectly clean, which was then heated, by means of a very large chafing dish: a space somewhat more than a yard square, was thus brought to a temperature, about equal to that of boiling water; the composition was then applied, by means of large brushes, taking care that the saturation should be perfect; to insure this, it was found necessary to operate upon some parts, two or three times, according to the porosity of the stone. The higher the degree of heat produced, the more perfect was the work, provided it was not sufficient to effect the burning of the oil.

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[*] In our last number, we gave a notice of the processes described in this paper. We have abridged the details given in the original memoir, so as to reduce it about one half, but have been careful to retain whatever appeared of importance. The degrees, weights, and measures, have been changed, for such as are in general use, in this country.—*Editor.*

After the cupola had been completely covered, and the composition had been allowed to harden, it was painted over with white lead and oil; this served as the ground-work for one of the finest productions in the arts, from the pencil of M. Gros; and which it is not doubted, will be equally durable with the dome itself, as it has now undergone the trial of eleven years, without the slightest alteration, excepting that which air, and light, necessarily produce on the colouring. The picture has not required any coating with varnish, as the ground entirely forbids the *sinking* of the oil.

The composition was afterwards applied to other compartments of the building, with equal success; in some instances, in which the stone was extremely hard, it was found to have penetrated to the depth of about one-seventh of an inch.

The same preparation was afterwards tried upon articles made of plaster of paris. Two specimens were exhibited, by Messrs. D'Arcet and Thenard, one half of each of which, had been impregnated with the composition, and the remainder left unprotected. These had been left for a very considerable length of time, under gutters; the defended parts remained entire, whilst the other portions were powerfully acted upon by the water, being extremely rough, in consequence of the disintegration and dissolution which had taken place. A greater degree of care was necessary in operating upon plaster, than is requisite with stone, as the latter will bear a degree of heat, which will decompose the former; it will, however, resist a temperature of from 200, to 250 degrees, which is sufficient for the purpose; it cannot safely have its temperature raised, so as to approach 300 degrees.

On rendering salubrious, apartments which are damp, and consequently unhealthy.

In works which are costly, the value of the wax, used in the foregoing process, is not worth consideration; but in preventing humidity in the walls of ordinary apartments, the cheapness of the material employed, is a point of importance; in this case, rosin may be substituted for the wax, taking two or three parts of it, to one of the prepared oil. This composition was used upon two rooms, the walls of which were covered with a saline efflorescence, and which were so damp, as to be useless, even in summer. The oil for the cement, was prepared as before directed, and with this, two parts of rosin were melted in a large pot, particular care being taken in the management of the fire. After the rosin was melted, the whole swelled up considerably, but eventually subsided: it was then removed from the fire, and suffered to cool, and afterwards was re-melted, as it was wanted for use.

A large furnace was used, together with such apparatus as was found necessary for removing it from one part of the wall, to another, so as first to dry, and afterwards to heat it, to the necessary degree.

From five to six coats were found requisite, before the plastering and wall, were completely saturated: when completed, the wall had a glossy appearance, and at length became quite hard.

Preparation of Ceilings intended to be painted.

It is believed that plastered ceilings may be rendered so impervious to moisture, that they will, not only resist the action of the humidity of the atmosphere, but also of that portion of moisture which frequently percolates through them, from rooms above. The cement may be made to penetrate entirely through the plastering, rendering it nearly as impervious as prepared stone. Colours on plaster, will in this case, be as durable as when used on canvass, whilst upon ordinary ceilings, they are destroyed in the course of a few years.

Plaster Statues, and bas-reliefs made to imitate bronze, and rendered unalterable by the action of the air.

The composition of wax and oil, may be united with the soap of copper and of iron, and will produce a green, unalterable by time, and perfectly similar to that of antique bronze. With this, the finest figures may be saturated, without injury to the most delicate touches of the graver, as the whole of the mixture is absorbed, leaving no sensible covering on the surface. By this process, we may procure statues, and other ornaments for our monuments, and for our gardens, at a very reasonable price; giving to them the colour of bronze, preserving them for an indefinite period, and making them, in all respects, superior to those painted over with oil colours. Specimens of articles, prepared and coloured by the process about to be described, were exhibited, when the memoir was read.

Method of preparing the composition for plaster figures.

Take pure linseed oil, and convert it into mild soap *(savon neutre)* by means of caustic soda, to which add a strong solution of common salt; then urge the boiling, until the lees begin to thicken, and the soap can be obtained in small grains, swimming upon the surface of the liquid. The whole is then placed upon a strainer, and when well drained, is to be put under a press to remove as much of the lees as possible. The soap is then dissolved in distilled water, and the hot solution strained through fine linen. In another portion of distilled water, dissolve a mixture of 80 parts of sulphate of copper *(blue vitriol)* and 20 of sulphate of iron, *(copperas;)* filter this solution, boil a portion of it in a copper vessel, and whilst boiling, add the solution of soap, in small quantities, until the metallic solution is entirely decomposed. When this point is attained, a fresh quantity of the solution of the sulphates, is to be added, stirring the whole occasionally, until it boils. The soap in a floculent form, will thus be formed in an excess of the sulphates; it should afterwards be washed in considerable portions of boiling, and of cold water, successively, then pressed in a cloth, to dry it as much as possible, in which state it is prepared to be used in the way to be described.

Boil one *kilogramme* (2lbs. 3oz. 5dr.) of pure linseed oil, with 250

Grammes (about 8¾ ounces) of litharge, in very fine powder; pass the product through a cloth, leave it on the stove, and it will soon become clear. This done, take of

Boiled linseed oil	300 *Grammes*	(about 10oz. 9dr.)
Soap of copper and iron	160 do.	(5oz. 9dr.)
Pure white wax		(ib.)

This mixture must be melted, by the heat of steam, or of boiling water, in an earthen vessel; it should be kept for some time in this state, to dissipate any moisture it may contain. The plaster must be heated in a stove, to 180, or 190 degrees; from whence it must be taken, to apply the fused mixture. When the figure cools, so as no longer to absorb the composition, it must be replaced in the stove, and heated as before, when more of the composition may be applied, until the work is saturated; after this, it should stand a few moments in the stove, that no portion of the colour may remain upon the surface, to injure the finer lines of the sculpture. Withdraw it from the stove, suffer it to cool in the air, leave it under cover for some days, or until the odour of the mixture has passed off, rub it with cotton or fine linen, and the work is finished.

Small articles may be dipped into the composition, and when withdrawn, any superfluous quantity may be removed, when on holding them before a fire, or otherwise heating them, the mixture will penetrate, so as to appear on the opposite side.

The reddish appearance of some antique bronzes, may be produced by increasing the quantity of iron, in the metallic soap. The soap of iron, alone, will give the brown red, of other bronzes, and the application of gold powder, to the prominent parts, will produce the desired metallic appearance.

The colour may be varied, by first colouring the plaster of any desired tint, by means of pigments dissolved in alcohol, or in water, and afterward applying a colourless metallic soap. White marble, may be imitated by soap of zinc, bismuth, or tin.

It would be proper to pour boiled linseed oil, into the interior of statues, to preserve them from the effects of humidity, and to prevent the necessity for using a large portion of the coloured composition.

The foregoing processes were all successfully tried; and clearly prove, that the plan may be advantageously pursued, for various purposes; such as preserving lower rooms, and vaults of prisons, from humidity; to prevent the leaking of cisterns; to render vessels of plaster capable of holding water; to harden statues of plaster, or of soft stone; and in many other instances, which will readily suggest themselves, and which it is therefore unnecessary to mention.

On Rotatory Steam Engines.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—In Stuart's history of the Steam Engine, is given a description of a Steam Wheel by Masterman, which he considers the best essay yet made, towards a Rotatory Engine, and that it is on a principle, most likely to be successful. The inventor's statement, gives it a superiority as to effect, over the best reciprocating engines; but the great diameter, required for the wheel, (28 to 30 feet) to obtain a column of water, sufficient for resistance on the low-pressure plan, would be a serious objection in many cases, and in some, an insuperable one.

This objection, has led me to consider the practicability of employing a column of quicksilver, or fusible metal, instead of water, whereby it would seem, that an engine might be formed, very powerful in proportion to its size and weight, particularly applicable to steam boats, and generally preferable, where a rotatory motion is required. The specific gravity of quicksilver, being between twelve and thirteen times that of water, it would appear, that a wheel of three or four feet diameter, charged with quicksilver, would give sufficient resistance for a low pressure engine; and a wheel of eight or nine feet internal diameter of ring, would be sufficient for high pressure, in its legitimate use, say 40 lbs. or 50 lbs. to the square inch. This, at the velocity given by Stuart, as the best, viz. 400 feet per minute, would increase the useful effect, much beyond the best reciprocating engines, in which the loss by friction, indirect application, &c. is usually allowed to be equal to half the impelling force—while in this wheel, the loss would be trivial.

I forbear giving a delineation of this machine, because you have Stuart's description at hand; and, should you think the subject sufficiently important, you will re-publish it, that the attention of the ingenious may be drawn to a principle, the most promising of any yet suggested, for a Rotatory Engine.

I would further remark, that though I perceive the use, I do not see the *necessity* for the regulating fountain, employed by Masterman, nor is it explained by Stuart.

The only objection I can apprehend to this engine, is, the waste of the quicksilver, and the corrosion of the iron. Considering it worth an experiment, I had taken measures, with a view thereto, to procure the full description of Masterman's wheel, published by the inventor, London, 1822; but presume, I am anticipated in my intention, for I have just seen a statement from a New York paper, that a wheel apparently similar, is in operation there, in which the reacting force is a column of quicksilver, and is said to work well; though the calculation made of its power, must be erroneous, for the velocity there given 30 × 60 is 1800 feet per minute—whereas, according to Stuart, the power would be 500 lb. × 400 feet per minute, 200,000 ÷ 33,000 = about six horse power, without any deduction for friction, &c. &c.; which, if allowed to reduce it to four horse power, would be a great result from a column, whose area can be but 500 ÷ 54 = less than 10 square inches, and would consume about one half the quantity of steam required for a reciprocating engine, of like power. It is hoped you will soon be enabled to give a full description of the steam wheel at New York. BELIDOR.

The following is the description of the Rotatory Engine, lately constructed in New York. This article appeared in the Daily Advertiser, of that city, and is that to which our correspondent, Belidor, refers.

"It is a simple wheel of cast iron, with three hollow arms, (or spokes,) and a hollow rim, capable of containing 10 gallons. The axis revolves with the wheel; but it has a hub, which is stationary, and through which the steam is admitted, and discharged. The size and weight, are to be proportioned to the power desired. The weight of the wheel is 150 lbs. The lower part of the rim is charged with a quantity of quicksilver, the use of which we shall soon explain.

"When one of the arms is turned to a horizontal position, a groove in the axis opens upon a hole in the hub, by which steam is admitted from the steam pipe through the arm. On entering the rim, it closes a valve just above the arm, and by its pressure against it, tends to move the wheel, while its downward force, presses down the quicksilver. When the arm reaches the perpendicular, it discharges the steam through the axis, in the same manner in which it received it. The second arm then reaches a horizontal position, opens a communication with the steam pipe, and becomes charged; the valve closing, and a new impulse being communicated to the wheel, and to the mercury. It will be easily understood, that as the three valves open the same way, the mercury passes freely through them, while the steam successively closes them.

"We saw this engine in operation, and, as far as we could judge, it seemed to possess great advantages, over all we had ever met with. We understand that it has met the approbation of several practical engineers, and is regarded as a successful attempt at the direct application of steam. Experiments have been made in England to attain this object; but were abandoned on account of certain obstacles, which now appear to be surmounted.

"A full load of quicksilver is from 500 to 600 lbs. and forms a moveable resistance or piston, while the friction is so small, that it cannot be perceived in moving it by hand.

"It is well known, by the use of the ordinary steam guages, that it requires one pound pressure of steam, for every inch which this column of mercury is raised out of level. The column of mercury in the rim of this wheel, is 108 inches in depth, and consequently will resist a pressure of steam to 54 lbs. the square inch;* so that it will be perceived this engine is capable of creating any power required, by increasing or diminishing the pressure of steam, from 1 to 54 lbs. pressure the square inch; and if permitted to revolve 60 times to the minute, with 50 lbs. pressure of steam, it will produce, as may be easily calculated, 40 horse power. Say, 500 lbs. 30 feet high, 60 times the minute, to be 45 horse power, according to the English calculation, of 20,000 lbs. one foot high in each minute a horse power. If it is desired to carry the steam at extreme high pressure, the diameter of the wheel must be increased, two inches for each pound pressure.

"The Boiler, in which the anthracite coal is used to great advantage, to make steam for this engine, is 4 feet in diameter, and 7 feet high, with a hemispheral top; it stands upright, and consumes from 4 to 500 lbs. of coal in twelve hours, and was invented by the same persons."

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* There is here some typographical error, or palpable miscalculation.—[*Ed.*

The above description is certainly inaccurate, as respects the calculations made; it appears to have been written for the purpose of giving some general idea of the construction of the wheel, by some one not scientifically acquainted with the subject. We do not think it necessary at present, to notice this point more particularly, as the main question is, whether an actual improvement has been made in the steam engine. We have seen the machine in question, but not under circumstances which would enable us to judge fairly of its merits, as it was not in operation; and, if it had been, we could only have seen that it actually went round; there not being attached to it, any thing by which its effective force might have been ascertained. The inventor did not pretend, that there was any novelty in the principle upon which it acted, but, that he had so constructed and improved the valves, that they were closed by the elasticity of the steam, and readily admitted the mercury to pass through them.* We think more favourably of this, than of most of the other plans, upon which rotatory engines have been constructed; and shall sincerely rejoice, should it ultimately prove to be, in all respects, better than the reciprocating engine; of this however, we have very strong doubts.

Numerous have been the plans proposed, and essayed, both in England, and in this country, for obtaining a direct revolving motion, from the action of steam; but hitherto, all such attempts have proved abortive, for although many of these engines have been constructed, they have been found, upon trial, to be less powerful, with the same expenditure of fuel, than a well constructed reciprocating engine, and more liable to get out of order. For ourselves, we confess, that our expectations of seeing the reciprocating, superseded by the rotatory engine, are by no means sanguine. We think, that projectors are generally mistaken, respecting the loss of power, which they think, takes place in the crank, and in reversing of the motion given to the piston, and its appendages. In this opinion, we are not singular, but have the support of many practical engineers. We shall be glad to see this subject discussed, by competent persons; it is one of great interest, and is by no means well understood. We are acquainted with those who are more capable of entering upon the investigation than ourselves, and earnestly invite them to illustrate the subject.

The boiler mentioned, as the invention of the same persons, we think, liable to several objections; but, as this forms no essential part of the plan, the discussion of its merits, is, at present, deemed unimportant.

It is probable, that we shall hereafter comply with the suggestion of Belidor, and re-publish the account of Masterman's engine.—[*Editor.*

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* Col. Stevens, of Hobocken, we believe, made a similar engine, but the oxydation of the mercury, and other difficulties, caused him to abandon it.

ON JAPANNING AND VARNISHING.—No. 5.

BY THE EDITOR.

White, or light coloured Spirit Varnishes.

We have formerly remarked, that although the varnishes made from lac, are, in some respects, preferable to any of those made from the more colourless resins, yet, they cannot be applied, where a tinge of brown would be inadmissible. Pictures, maps, the lighter coloured woods, inlayed work, japanned chairs, and other furniture, with ornamental painting or gilding, if finished with varnish, require such as is nearly colourless.

The resins principally employed, are mastic, sandarac, elemi, and animi. The two former, can always be procured; the two latter, are but little used, and therefore, only occasionally found in this country. Neither mastic or sandarac alone, makes a good varnish; sandarac is deficient in gloss; mastic in hardness, and solidity; they therefore are best, employed together; the following proportions will answer well, this is sometimes called,

Hard white Varnish.

Take Gum sandarac	- - - - -	9 ounces
Gum mastic	- - - - - -	3 "
Alcohol	- - - - - -	32 "

Tingrey, in his 'Varnisher's Guide,' advises, in making varnishes of this description, to pulverise the resins, and, to add about one third of their weight of pounded glass, when they are mixed with the alcohol; this prevents the particles of resin from agglutinating, and also, from adhering to the bottom of the vessel, which is apt to take place, if the ingredients are not shaken, or stirred very frequently; when this agglutination occurs, the dissolution becomes extremely difficult. Tingrey, also advises promoting the dissolution by means of a sand, or water bath. We have repeatedly made the sandarac and mastic varnish, and have always used the resins in the lump, breaking those pieces only, which are unusually large. We have never employed any higher degree of heat, than that of the sun, or a tolerably warm room, nor have we used the pounded glass; the only precaution found necessary, has been frequent shaking, and stirring with a stick; in this way, from 12 to 24 hours, will be sufficient to complete the process; and that, without either risk, or waste. In making varnish with alcohol, much of the spirit must evaporate, if heat be employed, as the vessel would burst, if not ventilated.

We shall hereafter describe the methods which have been adopted, to effect the solution of copal, in alcohol, which in the ordinary mode of procedure, has but little action upon it. The following recipe, we have not tried, and, if we had met with it in any common book, should unhesitatingly have condemned it. Tingrey, from whom it is taken, is very good authority, as he was not in the habit of trusting to others, but, was a careful and accurate experimentor. Every chemist knows, that articles which are insoluble in a particular fluid, when alone, are sometimes rendered soluble by the presence of others, and this is probably an example of that kind.

Varnish of Copal, Sandarac, and Mastic.

Take pounded copal, of an amber colour, and which has been once liquified, according to a method to be hereafter described, 3 ounces

Sandarac	6	"
Mastic	3	"
Clear turpentine	2½	"
Pounded white glass	4	"
Alcohol	32	"

All the solid ingredients, should be reduced to fine powder, excepting the glass, from which the finer particles should be separated by a sieve, and rejected; put the whole, the turpentine excepted, into a tin bottle, or matrass; which should then be placed in a vessel, containing water, a little warm; this must afterwards be heated to ebullition, and so maintained for an hour or two; a stick of white wood, must be used to stir the mixture, which must be done very frequently, as the heat will otherwise cause the resins to unite in a mass. When the solution appears to be nearly complete, add the turpentine, which must be melted, by immersing the vessel containing it, in boiling water. The heat must be continued for half an hour longer, when the varnish may be suffered to cool; during which process, it must be constantly stirred.

Tingrey remarks, that the opinion generally entertained of the insolubility of copal, in spirit of wine, would have inspired him with some doubt, as regards its usefulness in this varnish, had he not experienced, that a much more durable varnish was produced, than could be obtained without the copal. It is probable, that the whole of this resin will not be dissolved, and that a smaller portion than that indicated, would answer every useful purpose.

A larger portion of copal may be dissolved, if $\frac{3}{8}$ of an ounce of camphor be added to the ingredients; this quantity must not be exceeded, as it in some degree softens the varnish. We shall have occasion hereafter to speak more particularly of the employment of camphor, in facilitating the solution of copal in alcohol.

In digesting the ingredients, when making this, and similar varnishes, a glass matrass is usually recommended, and, it is on some accounts to be preferred, more particularly as its transparency admits of the progress of the dissolution, being readily observed. The experienced manipulator, may employ a vessel of this kind; but, in ordinary cases, the risk is great, and tin should be used. These varnishes may be filtered through cotton, or allowed to remain at rest, until the impurities subside, when they may be carefully decanted. We always prefer the latter mode.

On cleaning and Polishing brass, and preparing it for lackering.

By the Editor.

In our last number, we described the mode of preparing, and using lacker, for brass; the beauty of the work depends, however, as much upon its being properly prepared, as upon its being well lackered;

the mode of doing this, both upon old, and new work, shall now be described.

To remove the lacker from old work.

Resinous substances are soluble in potash; and as the lacker upon brass, is resinous, it may readily be removed, by means of ley, made from wood ashes. A portion of ashes and water may be put into a small iron pot, which must be made to boil; on dipping the work into the liquid, the lacker will be immediately removed, and if the surface of the brass be not corroded, it will require but little labour to prepare it for re-lackering. It ought not to remain longer in the ley, than is necessary to remove the lacker, otherwise the brass will become tarnished, and require considerable labour to polish it. When the articles are too large to dip into the ley, the lacker may be washed off, by means of a rag fastened on a stick. The strength of the ley will be greatly increased by putting some quick-lime into it.

After the removal of the lacker, the operations to be performed, will depend upon the nature of the work, and the degree in which the surface has been scratched, or corroded. The directions to be given for new work, will apply equally well, to old. Wrought work, that is, such as is not finished with the file, or turned, but consists of foliage and other ornaments, will, if much soiled, require to be annealed, that is, heated to redness in the fire, and otherwise managed as new work.

On Finishing, Burnishing, or Polishing, brass work.

Articles which are filed up, or turned, are in general either polished, or burnished, preparatory to their being lackered. Work which is well turned, requires but little polishing. For preparing, and polishing brass, different articles are recommended, and employed, by different workmen; we have found that fine glass paper covered with sweet oil, will give a perfectly smooth surface; which may then be polished with oil and rotten stone, upon a woolen rag, and cleaned off with fine dry whiting, upon a piece of cotton or linen. The use of glass-paper and oil, was adopted by us many years since, and we believe, was then new: it is adapted both to coarse and fine work, and has the advantage of producing the desired effect, with greater rapidity than any other method, with which we are acquainted. Glass-paper, is frequently called sand-paper, and is often sold under that name; sand-paper was formerly much used, but is now almost unknown, the glass-paper being much superior to it, for all purposes. Emery-paper is sometimes used; for iron, it is a very good article, but for brass, is not better than glass-paper, which is much cheaper; if not sufficiently fine, the glass paper may be made so, by rubbing it with the pane of a hammer.

Work which is filed, may also be finished in the way above described. For flat work, the glass-paper is wrapped round a suitable piece of wood, and after being oiled, is used in the manner of a file. It may then be polished with oil and rotten stone, upon a woolen or leather buff. The finest kind of work, after being smooth-filed, is rubbed with a piece of wet pumice stone, afterwards with blue stone, and then with charcoal; this leaves it with a perfectly fine surface, well prepared to receive a polish from oil and rotten stone, with but little labour. There are several species of stone, in different parts of the Union, which may be substituted, both for the pumice stone, and the blue stone. Instead of the latter, the Scotch stone, called, *water of ayr*, is often used : this exists in abundance, in the State of North Carolina. The best charcoal, is that made from willow, but good pieces may generally be picked out from a heap; they, however, can be judged of, by trial only. The rubbing with charcoal, is a slow business, and may, in general, be dispensed with.

When a bright polish is not desired, but the work is to appear with a fine surface, the *grain* may be laid with the glass-paper, and oil; with oil and fine powdered pumice stone, or with the finest washed emery and oil, upon a buff.

Burnishing on brass, is performed only on inferior kinds of work, or upon such parts as do not admit of being polished. A burnished surface is the most brilliant, but has much less *truth* than one which is well polished. For brass, steel burnishers are always used. The general directions in the article on burnishing, extracted from the *Dictionnaire Technologique*, and published in our present number, may be referred to, upon this subject. In burnishing small articles, the burnisher may be moistened by touching it with the tongue: weak beer is frequently used for larger work, instead of the soap-suds, used with silver, as mentioned in the paper just referred to. After burnishing, the articles are washed clean, and wiped perfectly dry, when they are fit for lackering.

On finishing wrought work.

Wrought work, after having the parts which are intended to be burnished, either scraped or filed, is to be annealed in a charcoal fire; a pickle is then made, by pouring aqua fortis *(nitrous acid,)* into water, until it is intensely sour; into this pickle, the articles are put, and suffered to remain, until all the black scale is removed, and the whole surface exhibits one clear, uniform, red; they are then to be taken out, washed and dried, when they are ready for *dipping*, or *taking off*. Some clear aqua fortis is poured into a cup, and the article, if small, is dipped into it, and immediately removed; otherwise it is washed over, by means of a piece of rag, tied on to the end of a stick; the acid immediately boils up, when it must be washed off, by being passed successively, into two or three vessels containing water, as the smallest remaining portion of acid, will cause the surface to tarnish. A little practice will enable the operator to judge of the instant when the acid should be washed off, by the colour which it assumes. The surface will now exhibit a clear and beautiful gold yellow, provided the brass, and the acid, are both of a proper quality. The parts which are to be burnished undergo that operation, either by hand, or in the lathe, according to the nature of the articles. The usual mode is to put them into small beer, from which the pieces are successively taken and burnished, when they are thrown into clean water.

and dried in the saw-dust of some wood which is not resinous. Sometimes the work is scratch-brushed, before burnishing; this however, removes that beautiful dead appearance, which is in general preferred, and leaves a general brightness, upon the unburnished parts.

The scratch-brush is made of small brass wire, formed into bunches, which for large work, are fixed around a chuck, and made to revolve in the lathe ; beer is used in this operation, as in burnishing.

FOR THE FRANKLIN JOURNAL.

Observations on the Hydraulic Cement, used on the Pennsylvania Union Canal.

Every one, who from curiosity or interest, has visited the Union Canal, which is intended to form a junction of the Susquehanna, with the Schuylkill, has seen with the highest satisfaction, the solid and beautiful masonry, with which the locks on the Canal are constructed. Many of these works have been completed upwards of a year, and their foundations have been covered during that time, with water. They exhibit the most solid and unimpaired appearance, alike uninjured, by remaining either wet or dry, and by cold or heat.

The stone work of these works, has been laid in water lime, invented by Mr. Guilford, the cost of which, is less than one third of that of Roman cement, for which it is a complete substitute.

Mr. Guilford, is one of the most distinguished engineers of the Union Canal, and he has, on request, furnished the following account of this most valuable material, and of the mode of using it—he has obtained a patent for the discovery of the water lime. His address now is, Lebanon, Pennsylvania, or the Union Canal office, Philadelphia. P.

A description of the Mineral, from which the Pennsylvania Cement is manufactured.

This mineral occurs in masses, associated with compact limestone, and argillaceous slate—its structure, though usually slaty, is sometimes stratified—sometimes also, its masses are composed of columnar distinct concretions—its cross fracture is uneven, and its longitudinal fracture, even and dull, or foliated, with a lustre, more or less shining and vitreous. Its colour is black, or bluish-black; it effervesces with acids; and when calcined, its colour is yellowish, or reddish-brown. A specimen, analyzed by Dr. Seybert, yielded

Carbonic acid and water	23.66
Lime	20.66
Silex	32.
Alumine	12.66
Magnesia	1.71
Oxide of iron	5.66
	96.35
Loss	3.65
	100.00

The manner of preparing the Cement, is as follows.

The stone is calcined in kilns, then ground to a powder, and mixed with clean sand, in various proportions, usually by equal measure. The cement should be ground, soon after it is calcined, and kept so that no wet, or damp, be suffered to come in contact with it; nor should it be much exposed to the air before it is used. The cement and sand, should be mixed together dry, and then, as little water added as may be necessary to form the mortar into a uniform paste, when it is well beaten. If the cement be mixed with sand, by equal measure, it will require about 3⅓ bushels, to construct a cubic yard of masonry. S. GUILFORD.

Note by the Editor.—Our correspondent P. informs us, that a patent has been taken out by Mr. Guilford, for the Hydraulic Lime. We are at a loss to know, for what discovery, or improvement, in the nature of the materials, or in the mode of using them, the exclusive right is claimed; so far as appears in the papers before us, there is not any thing new in either; and, excepting there is something special, which is at present out of sight, we cannot perceive how a claim to an exclusive privilege, could, in the present instance, be sustained, any more than it could for common mortar, made from a newly discovered bed of lime-stone. We do not pretend to much knowledge in the law, but apprehend, that the "discovery," contemplated in the patent law, is not the discovery of minerals, deposited by the hand of nature, under the surface of the earth. These remarks, are made with deference, as the respectability and intelligence of the persons concerned, are such, as to induce us to suppose, that we may have fallen into the common error, of judging, without a sufficient knowledge of all the premises.

On Burnishing.[*]

To burnish an article, is to polish it, by removing the small eminences or roughnesses, upon its surface; and the instrument by which it is performed, is denominated a BURNISHER. This mode of polishing, is the most expeditious, and gives the greatest lustre to a polished body. It is made use of by gold and silversmiths, cutlers, locksmiths, and most of the workmen in gold, silver, copper, iron, or steel. It removes the marks left by the emery, putty of tin, or other polishing materials; and gives to the burnished articles, a black lustre, resembling that of looking-glass. The burnisher is an instrument, the form and construction of which, is extremely variable, according to the respective trades; and, it must be even adapted to the various kinds of work, in the same art. We shall point out the principal ones. In general, as this tool is only intended to efface inequalities, whatever substance the burnisher is made of, is of little consequence to the article burnished, provided only, that it be of a harder substance than that article.

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[*] From the *Dictionnaire Technologique.*

We shall first describe the art of burnishing silver articles, and afterwards point out the variety of modes in which the burnisher is used, in other arts.

When silver articles have received their last fashion from the silversmith's hands, that is to say, when they have been worked, soldered, repaired, or adjusted, they are sent to the burnisher, who has the care of finishing them. He must begin, by cleaning off any kind of dirt which their surfaces had contracted whilst making, as that would entirely spoil the perfection of the burnishing. For this purpose, the workman takes pumice-stone powder, and, with a brush, made very wet in strong soap-suds, he rubs, rather hard, the various parts of his work, even those parts which are to remain dull; and which, nevertheless, receive a beautiful white appearance. He then wipes it with an old linen cloth, and proceeds to the burnishing.

The burnishers used for this purpose, are of two kinds; some of steel, others, of hard stone. Steel burnishers are either curved or straight; rounded or pointed; and made so as to suit the projecting parts, or the hollows of the piece.

Stone burnishers are made of blood-stone (*hæmatite*) cut, and either rounded with the grindstone, or rubbed, so that they present at the bottom, a very blunt edge, or sometimes a rounded surface. These are polished with emery, like steel burnishers, and are finished by being rubbed upon a leather, covered with *crocus martis*. The stone is mounted in a wooden handle, and firmly fixed by means of a copper ferrule, which encircles both the stone and the wood. The best blood-stones, are those which contain the most iron, and which, when polished, present a steel colour.

The operation of burnishing, is very simple: it is only requisite to take hold of the tool very near to the ferrule or the stone, and lean very hard with it, on those parts which are to be burnished, causing it to glide by a backward and forward movement, without taking it off the piece. When it is requisite that the hand should pass over a large surface at once, without losing its point of support on the work-bench, the workman, in taking hold of the burnisher, must be careful to place it just underneath his little finger. By this means, the work is done quicker, and the tool is more solidly fixed in the hand.

During the whole process, the tool must be continually moistened with black soap-suds. The water with which it is frequently wetted, causes it to glide more easily over the work, prevents it from heating, and facilitates its action. The black soap, containing more alkali than the common soap, acts with greater strength in cleansing off any greasiness, which might still remain on the surface; it also more readily detaches the spots, which would spoil the beauty of the burnishing.

In consequence of the friction, the burnisher soon loses its bite, and slips over the surface of the article, as if it were oily. In order to restore its action, it must be rubbed, from time to time, on the leather. The leather is fixed on a piece of hard wood, with shallow furrows along it. There are generally two *leathers*—one made of sole-leather, and the other of buff-leather. The first, is impregnated with a little oil and *crocus martis*, and is particularly used for the blood-stone burnishers; the other, has only a little putty of tin, scattered in the furrows, and is intended exclusively, for rubbing steel burnishers, as they are not so hard as the blood-stones.

Blood-stone being very hard, the workman uses it whenever he can, in preference to the steel burnisher. It is therefore only in small articles, and in difficult places, that the steel burnishers are used; as they, by their variety of form, are adapted to all kinds of work. But in general, the blood-stone greatly reduces the labour.

When the articles, on account of their minuteness, or from any other cause, cannot be conveniently held in the hand, they are fixed in a convenient frame on the bench: but under all circumstances, the workman must be very careful to manage the burnisher, so as to leave untouched, those parts of the work, which are intended to remain dull. When, in burnishing any article, which is plated or lined with silver, he perceives any place, where the layer of precious metal is removed, he restores it, by silvering these places, with a composition supplied by the silverer, which he applies with a brush, rubbing the part well, and wiping it afterwards, with an old linen cloth.

The burnishing being finished, it only remains to remove the soap-suds, which still adheres to the surface of the work: this is effected, by rubbing it with a piece of old linen cloth, which preserves to it all its polish, and gives so great a lustre, that the eye can scarcely bear to look upon it. But, when the workman has a great number of small pieces to finish, he prefers throwing them into soap-suds, and drying them afterwards with saw-dust, which is more expeditious.

The burnishers of articles which are not silver, follow nearly the same process, as that above described. We shall briefly notice the variations to be observed in each case.

The burnishing of leaf-gold or silver, on wood, is performed with burnishers made of wolves' or dogs' teeth, or agates, mounted in iron, or wooden handles. When they burnish gold, applied on other metals, they dip the blood-stone burnisher, into vinegar; this kind being exclusively used for that purpose. But when they burnish leaf-gold, on prepared surfaces of wood, they are very careful to keep the stone, or tooth, perfectly dry. The burnisher used by leather-gilders, is a hard polished stone, mounted in a wooden handle; this is used to sleek, or smooth the leather.

The ordinary engraver's burnisher, is a blade of steel, made thin at one end, to fit into a small handle, which serves to hold it by. The part in the middle of the blade, is rounded on the convex side, and is also a little curved. The rounded part, must be well polished, and the tool be very hard.

They use this burnisher to give the last polish to copper-plates, rubbing them well with it, and being very careful to use oil continually, to lubricate it. Other burnishers, are nearly of the same form as those used by the gilders and silverers.

In clock-making, they burnish those pieces or parts, which, on account of their size or form, cannot be conveniently polished. The burnishers are of various forms and sizes; they are all made of cast-steel, very hard, and well polished : some, are formed like the sage-leaf files; others, like common files: the first, are used to burnish screws, and pieces of brass; the others, are used for flat-pieces. The clock-makers have also very small ones of this kind, to burnish their pivots; they are called *pivot-burnishers.*

The burnishing of pewter articles, is done after the work has been turned, or finished off with a scraper: the burnishers are of different kinds, for burnishing articles either by hand, or in the lathe; they are all of steel, and while in use, are rubbed with putty powder on leather, and moistened with soap-suds.

The burnishing of cutlery, is executed by means of hand, or vice burnishers; they are all made of fine steel, hardened, and well polished. The first kind, have nothing particular in their construction; but the vice burnishers, are formed and mounted in a very different manner. On a long piece of wood, placed horizontally in the vice, is fixed another piece, as long. but bent in the form of a bow, the concavity of which, is turned downwards. These two pieces, are united at one of their extremities by a pin and a hook, which allows the upper piece to move freely around this point, as a centre. The burnisher is fixed in the middle of this bent piece, and it is made more or less projecting, by the greater or lesser length which is given to its base. The moveable piece of wood, at the extremity opposite to the hook, is furnished with a handle, which serves the workman as a lever. This position, allows the burnisher to rest with greater force against the article to be burnished, which is placed on the fixed piece of wood. They give to the burnisher, either the form of the face of a round-headed hammer, well polished, to burnish those pieces which are plain or convex; or the form of two cones, opposed at their summits, with their bases rounded, to burnish those pieces which are concave or ring-shaped.

The burnishing of the edges of books, is performed with a wolf's or dog's tooth, or a steel burnisher: for this purpose, they place the books in a screw press, with boards on each side of them, and other boards distributed between each volume; they first rub the edges well with the tooth, to give them a lustre. After sprinkling or staining, and when the edges are become dry, they first burnish the front; then turning the press, they burnish the edges at the top and bottom of the volume.

They burnish the gilt edges in the same manner, after having applied the gold; but observe, in gilding, to lay the gold first upon the front, and allow it to dry; and, on no account, to commence burnishing till it is quite dry.

FOR THE FRANKLIN JOURNAL.

Remarks upon the Use of Anthracite, and its Application to the various purposes of domestic economy.

The use of the anthracite, as a fuel, has been so generally approved, that it seems likely to supersede, to a great degree, all other substances both in manufactories and families. In almost every case, where it has been tried for parlour use, it may be said to have gained the preference over, even the best hickory wood; and it is not unlikely that at no distant day, it will obtain an equally firm footing in our kitchens. Notwithstanding however, the number and variety of trials that have been made, it does not appear that any particular form of grate, or size of flue, has as yet obtained a general, or decided preference: in fact, it is rather remarkable, that some of the first attempts should be adhered to, when their inconveniences are but too obvious. This is probably attributable to the want of a collection of facts, ascertained with correctness, which might serve to settle the general principles applicable to the subject. To assist in forming such a collection, the following remarks are put upon paper, by an individual who has given much attention to the use of the anthracite, during the last four years. It is quite probable, that similar observations may have been made by others, but as the results were new to himself, and to almost all with whom he has conversed, he is inclined to believe that, if known, they have not received the attention to which they are entitled.

The first experiments were made on the fourth, fifth, and sixth, of the fourth month, (April,) 1826, and were intended to determine, whether a great draught, and a small flue, are indispensable, in order to burn the coal with ease, and to produce the quantity of heat required for ordinary purposes, and were made in the following manner.

A common cast iron Liverpool coal grate, was placed in a large open wash-house chimney, and being merely supported upright, by means of dry bricks, the flue was left of its ordinary size as when used with a large wood fire. The fire chamber of the grate, was entirely of iron and not lined with brick, or any other substance. A fire was first kindled with Swatara coal, as being the easiest to ignite, and was continued throughout a day. On the following day, a fire was made of Schuylkill coal, and on the third day, of the Lehigh. In each case, the fire was as good, as those made of the same kinds of coal, in other grates, and required about the same attention to keep up the combustion; the Swatara coal, requiring the smallest quantity of charcoal to kindle it, and the Lehigh, the largest; whilst a much greater proportion of the former, was bright and glowing, than of the latter. The Schuylkill coal, appeared to be at a medium between the two, in these respects.

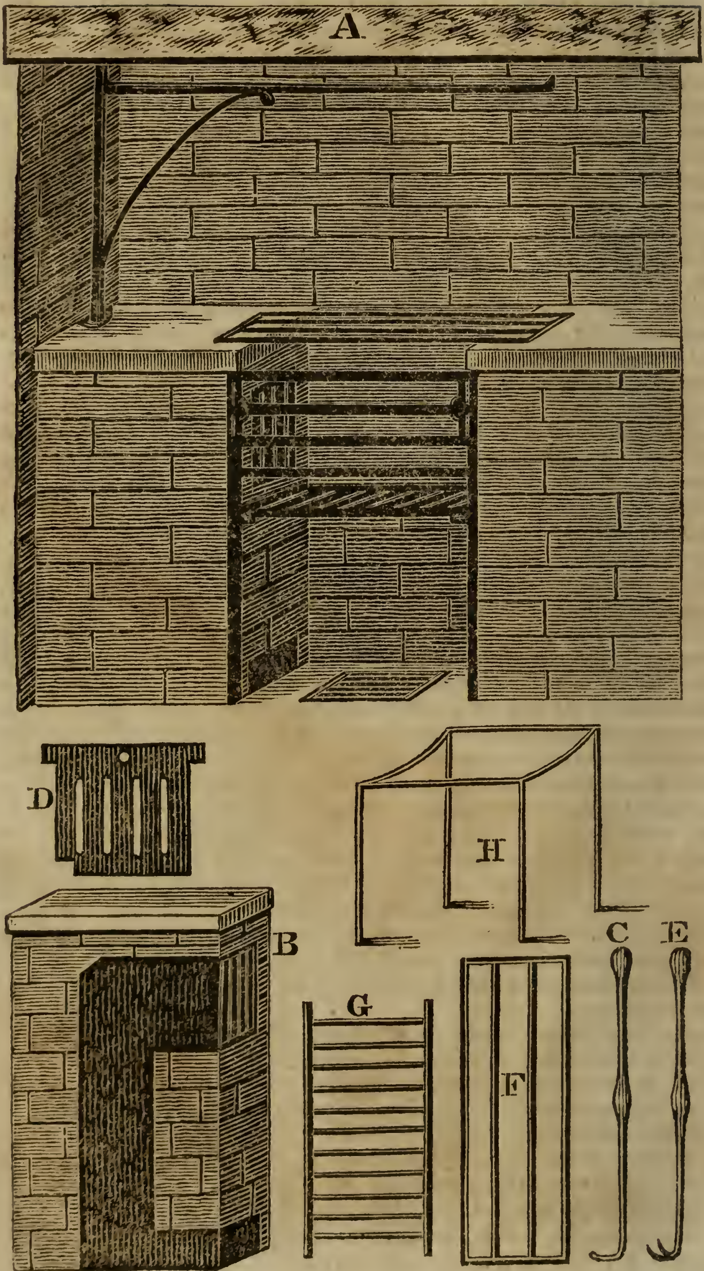
Another trial was made by placing several iron bars upon the andirons, in an open Franklin stove, upon which the coal was burned with perfect ease, making a beautiful fire, and casting out a heat quite equal to that from wood.

From these results, it seems that a small flue, and a great draught, are not indispensable, for the purpose of making a good fire of anthracite. The latter, it is true, is of some importance in kindling the fire, but if a blower be used, the draught will be greater, and the fire be more quickly kindled, with a wide flue, than with a narrow one. The common objections to a fire of anthracite, now that the difficulty of kindling is surmounted, are, that it throws more dust into the room than wood does, and imparts an unpleasant dryness to the air. These objections are certainly in many cases well founded, and their removal is of importance to persons of delicate constitutions, and to those who are studious of neatness in their parlour arrangements. That they generally, if not always, proceed from having the flue too much contracted, and the grate too much projected into the room, there can be no doubt. By an increase in the size of the flue, and by placing the grate more backward in the chimney, the objections here referred to, may be entirely obviated; but, in that case, it may be needful to increase the size of the grate, so as to produce an increased quantity of heat, as a portion of it must necessarily escape, by an enlargement of the flue. A parlour grate, erected in conformity to these views, is found to answer perfectly well.

The next experiment, was made in order to determine whether the common culinary operations of a family, could be carried on as conveniently with coals, as with wood. For this purpose the first mentioned grate was removed, and placed in a common kitchen chimney, with a wide flue, and open front; and all the usual processes of family cooking, &c. were tried, and found to answer in the most satisfactory manner. The use of this grate was continued for some weeks, until the plan of another was fully decided upon, embracing alterations calculated to obviate some small inconveniences. This grate having been permanently erected in place of the former, it has been used daily, with the anthracite coal, during the last four months, for all the kitchen purposes of a small family, (except baking of bread, which has not been tried,) and has proved as complete in all respects, as the common wood fire. In some points it is in fact preferable, as it does not require the cook to stoop, as at a wood fire, and the fuel is supplied with much less labour; and the steam and other exhalations being carried off by the open flue, the comforts of the kitchen, are in no way diminished, but, on the contrary, increased, by an entire exemption from the too common annoyance of smoke.

The following is a plan, and description, of the kitchen grate, thus put into use.

A. Front view of the chimney-place, grate, crane, &c.
B. The side flue, to assist the draught.
C. Poker, about three feet in length.
D. A cast iron plate, used to partition off a part of the grate, so as to make a small fire.
E. Hook, for lifting and drawing out the moveable bottom of the grate.
F. Guard iron to be placed above the fire for pots, &c. to stand upon.
G. Bottom of the grate, made moveable.
H. Stand, for the tin roaster.


A
D
H
B
C
E
G
F

The fire-place is three feet ten inches high, and three feet ten inches wide.

The grate is one foot six inches wide, nine inches deep, and the bottom, fourteen inches above the hearth; the bars are three quarters of an inch in thickness, and the space between them, an inch and a half: the bottom bars, are half an inch thick, and an inch apart. The front bars, are of square iron, and the upper one is moveable, and falls forward, so as to be on a level with the second, forming a convenient situation for a toaster, or other article, to be placed before the fire.

The side platforms, are two feet one inch high, containing the side flues, which are two and a half inches, by four inches, covered at top by a soap stone slab.

The main flue is five inches and a half wide, and runs all across the chimney.

The guard iron, is one foot ten inches long, and nine inches wide, with bars, half an inch square, and two inches asunder.

The dividing iron D, corresponds with the dimensions of the grate.

This grate* is of a size suited to a small family, but by extending its dimensions, accommodation may be had for the largest establishments. A second crane may be added, and the depth towards the back of the chimney, increased, without injury to the other arrangements. The usual operations of boiling, roasting, and broiling, in a proper state of the fire, may be performed with the greatest ease; and after being accustomed to the use of it, there is little doubt, but our cooks would, in general, prefer the coal fire, to the wood.

The kitchen fire, referred to, has always been kindled without a blower, merely by using dry bark, which, on experience, is found to be extremely well suited for the purpose; and in case of the fire sinking below what may be required for any particular operation, it may be revived, by adding a few pieces of wood or bark. But a blower may often be a convenience, and may be made with a common sheet of iron, adapted to close the chimney from the grate, upwards.

It has been found by experience, that the softer kinds of coal, are the best for small fires, and for cooking in general, as they burn more freely than the harder kinds. With all kinds however, especial care must be taken, to have provided a supply of dry oak, or hickory wood, bark or charcoal, as, without one or the other of these, always at hand, great inconvenience may be sustained. Pine-wood, cedar, or chips, are of little, or no use, to kindle the coal.

There is an advantage in keeping coals upon a flooring of boards or brick, so as to prevent their being mixed with earth, a very small quantity of which, will injure the fire: and coal, loaded by hand, is preferable for grates, to that moved with the shovel, as the fine stuff, is also injurious to a grate fire, though it may be advantageously used in a close stove.

Both parlour and kitchen grates, upon the plans above mentioned, have been found to answer so fully, that the writer of these notes, has made no provision for a wood fire, in his house. J. V.

11 Mo. 1, 1826.

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* It was made by Stephen P. Morris, corner of Third and Walnut streets, and put up by Raper Smith, Arch, near Fifth street.

FRANKLIN INSTITUTE.

Committee of Inventions, Sept. 12th, 1826.

The committee of inventions, who, at the request of Mr. James Vaux, of this city, have examined his kitchen grate, and other arrangements, for the burning of anthracite coal,

Report, That the object which Mr. Vaux had in view, in the experiments which he has made, was to ascertain, whether anthracite might not be burnt in an ordinary, open fire place, and applied to all the purposes of domestic economy, for which wood, or bituminous coal, is generally used. As it is the intention of Mr. Vaux to describe his apparatus, and to communicate his observations to the public, the committee deem it unnecessary for them to enter at large on the subject, and they will therefore, merely state, that, in their presence, fires were readily kindled, without using a blower, both in a grate constructed for cooking, and other purposes, and standing in an open fire place in the kitchen; and also, in a common, cast iron, English grate, placed in a parlour fire place, without altering the existing size or form, of the opening or throat of the chimney; and that it appeared evident to them, that all the purposes proposed by Mr. Vaux, were perfectly attained. It was not pretended by the experimentor, that he had made any discovery, which could be denominated new, but, only that he had succeeded in proving erroneous, an opinion, which is still generally prevalent, viz. that anthracite, cannot be used for cooking, excepting in a stove; a grate, forbidding its convenient use, in consequence of the supposed necessity for bringing forward the back, and closing the throat of the chimney.

The committee believe, that Mr. Vaux has perfectly succeeded in proving the incorrectness of this opinion.

By order,

THOS. P. JONES, *Secretary.*

Proposed Geological Survey of the State of Pennsylvania.

A public address, intended to promote a Geological and Mineralogical survey of this state, was delivered in the Hall of the Franklin Institute, on the 30th of September, by Peter A. Browne, Esq.

The meeting was very respectably attended, and when the address was concluded, Dr. R. M. Patterson, was called to the chair, and Gerard Ralston, Esq. appointed secretary. Resolutions were then passed, approbating the proposition, and complimenting the gentleman, who had delivered the address. A committee was appointed, consisting of Peter A. Browne, C. C. Biddle, E. S. Burd, Stephen Duncan, John Wurts, Dr. R. M. Patterson, Gerard Ralston, and Henry S. Tanner. This committee, was requested to report to a future meeting, a plan for carrying the proposition into effect; for which purpose, they were authorized to call another meeting of the citizens.

The address has been published, and a short abstract of it, will undoubtedly be acceptable to our readers.

After noticing the importance of Geology and Mineralogy, in their connexion with general science, and the particular inducements and facilities, which the United States afford, for the prosecution of these studies, a plan is proposed, for the attainment of the main object of the address.

As an encouragement to the prosecution of the survey, it is stated, that the services of that eminent Geologist and Mineralogist, Mr. Lardner Vanuxem, can be procured. This gentleman, was educated at the celebrated school of Mines, in Paris, and is now a professor in the college of South Carolina. In the department of drawing and engraving the maps, Mr. Henry S. Tanner, of this city, has offered his services; his abilities in that line, are very generally known.

It is proposed, to divide the whole state, into 26 districts, each district, to embrace from one, to three counties; and to be made the subject of a separate geological map; the engraving, and publication of which, shall proceed, as the districts are successively surveyed. The whole, to be engraved on a scale, of two miles to an inch, and to contain all the geographical information now possessed, or which may be furnished by the survey. It is supposed, that the survey may be completed in five years, and that the expense will be about $3,000, per annum, and that this expense, together with the cost of executing the maps, and transporting and arranging the Mineralogical and Geological collections, which will be made, may be defrayed by the sale of the maps; provided, fifteen hundred subscribers can be obtained, at one dollar for each map.

Besides, a grand collection of the Geology and Mineralogy of the whole state, to be arranged in geographical order, it is proposed to supply a county collection, to each county that furnishes thirty subscribers.

Attention is called to the importance of this survey, in aiding the exertions, now making for the internal improvement of the state; as it would point out all those facts, most important to be known. Notice is also taken of the advantages, which would accrue to the manufacturing interest, by the discoveries, which must result from such a survey, as it will bring to light those metals, earths, and combustibles, which are employed in the various arts and manufactures, and point out the places most suitable for manufactories.

Agriculture, it is said, will be greatly promoted by this survey, as it will not only make the places known, where those valuable minerals may be obtained, which serve to enrich the soil, when employed as manures; but it will also render the fact manifest, that there are extensive portions of the state, in which the land is excellent in quality, and which by their vicinity to water courses, or to mineral treasures, will offer encouragements to the cultivator of the soil, of which he is not, at present, aware.

We must now close our notice of this address; the importance of the subject is evident to all, and should not the present effort succeed, it will still be productive of benefit, by awakening public attention, and; perhaps, by pointing out to others, the road in which we ought to have travelled.

ENGLISH PATENTS.

Specification of the Patent granted to John White, *the younger, and* Thomas Sowerby, *both of Bishop-Wearmouth, in the county of Durham, Merchants, for an improved air furnace, for the purpose of melting or fusing metallic substances.* Dated November 6, 1824.

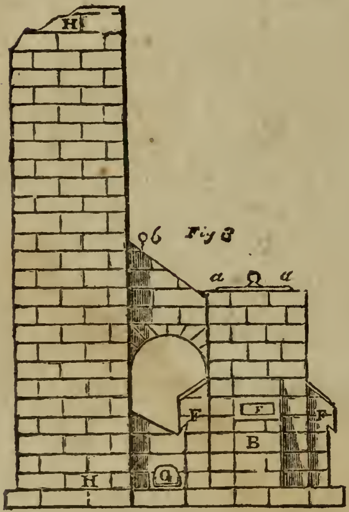


Fig 3

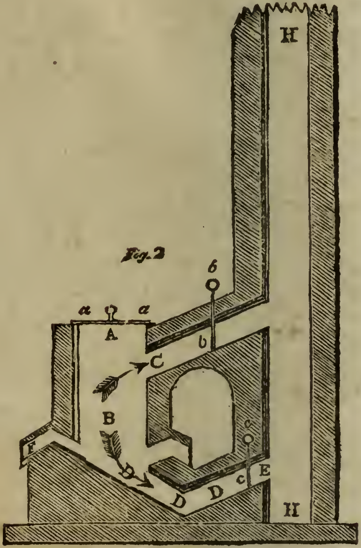
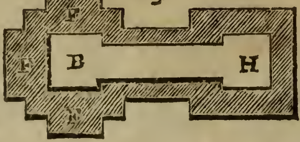


Fig. 2

Fig. 1



To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, we, the said John White and Thomas Sowerby, do hereby describe and ascertain the nature of our said invention, and in what manner the same is to be performed, reference being had unto the drawings hereunto annexed, (that is to say): Our invention of an improved air furnace, for the purpose of melting or fusing metallic substances, consists in our so adapting it as to have the means of giving to the current, or currents, of air admitted by a flue or opening, or by flues or openings, in the side or sides of the furnace, different directions through the fuel, as the heat is required to be applied; and of using coke or other fuel, with greater advantage than has hitherto been done, without the aid of a mechanical power, as used for the blast furnace or cupola. One example of our invention we shall give as follows (that is to say):—

Fig. 1 in the cut, shows a ground plan of our improved air furnace, as adapted for melting pig, or cast iron, for foundry purposes, which operation has been usually performed by means of the common reverberatory furnace, or by a small blast furnace, otherwise called a cupola.

Fig. 2 represents a section of our improved air furnace.

Fig. 3 shows an elevation of the same furnace.

The preceding figures, are drawn to a scale of 4 feet to an inch,* and the same letters, refer to the same parts, in each figure. AB represents the upright, or vertical part of the furnace: DDD the bottom or bed place, which is open into, or communciates with a flue, or chimney at E: C an opening from the furnace also, into or communicating with a flue or chimney: F the air flues, by which atmospheric air is admitted, of which there may be one or more: G a man-hole or opening for clearing out or preparing, the bed place or flue: HH the main flue or chimney, the height of which is required to be about the same as for the common reverberatory furnace; *aa* a cast iron cover for the top of the furnace: *bb* a plate or damper for regulating the capacity of the flue: *cc* a plate or damper for the like purpose. The darts point out the direction of the currents. The furnace and bed place, DDD, being cleared and prepared, the cover *aa* is taken off, and the coke or fuel is put in at A, which is lighted at the air flue or flues, or other convenient opening. When the furnace has come to a sufficient degree of heat for melting, well known to any workman used to, and competent to attend the reverberatory furnace or cupola, the man-hole or opening, G, being closed in the ordinary way of closing such openings in furnaces, by a loom cake or otherwise; the metal to be melted, and coke, are then put in alternately at A, in such way, quantities, and proportions, as they are generally done in the small blast furnace, or cupola. The cover *aa*, which is taken off to put in the coke or metal, is replaced as soon as that is done. As the metal is melted, it is precipitated to the bottom or bed at DDD, where it is kept hot by a current of flame passing over it to the flue or chimney, in the direction of the dart BE, and whence it is drawn off for use at *o*. The foregoing example of the application of our improved air furnace, will be sufficient to enable a workman to construct one, for the purpose of melting, or fusing, other metallic substances; but the furnace may be either square, or round, or oval, or octagon, or any other form, retaining the power of giving to the current or currents of air admitted by a flue or opening, or by flues or openings in the side or sides of the furnace, different directions through the fuel, as the heat is required to be applied.

In witness whereof, &c. &c. &c.

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* By the scale in the engraving, from which the cuts were taken, we should have supposed the drawing to be on a scale of eight feet to an inch.—[*Editor*.

Observations by the Patentees.

In the foregoing specification it is stated that the patent air furnace is applicable to various metallurgical purposes.

To enter into all the particular cases in which it may be advantageously adopted, and to illustrate them individually, by example, would be a work more fit for a series, than for one article in a periodical journal. Therefore, as an example has been already given of it as adapted for melting cast iron, the present observations are designed more particularly to show its advantages over the means now used for *that purpose*, than necessarily come within the limits of a specification. A reverberatory air furnace, or a cupola (a small blast furnace,) is generally used for melting pig, or cast iron. That so little has heretofore been done towards bringing to perfection a more complete and economical furnace than either of them, is somewhat surprising. They are each very expensive, both as regards their original cost and their subsequent operations. They are widely different in their principles, and reciprocally possess advantages over each other, whilst neither of them is adapted for all the purposes of a foundry furnace. Such being the case, a cheap and simple furnace, which combines all that is desirable in both, and is free from all that is objectionable in either, and which performs its operations at a considerably less cost, must be considered an important and useful invention. That the patent air furnace fully answers the above description, will appear from the following comparisons of it, with the reverberatory and the cupola respectively, than which, we are persuaded, further arguments will not be required to secure its adoption in the cast iron foundry.

The Patent Air-furnace, and the Reverberatory Air furnace, compared.

Firstly,—The reverberatory is a large and expensive building. The patent furnace is a compact and cheap erection; it will generally be found not to occupy one fourth as much ground as the former, and in its construction there is a much less proportion of expensive materials; no grate-bars, and very little other iron work, being required for it: neither need the chimney be lined to the top, with fire bricks.

Secondly,—The reverberatory is supplied with air by natural means, without the aid of machinery; and so, also, is the patent furnace. But the quality of the air supplied to the fire in each is different. The air, on its way to the former, passes through the heated ash pit, and is thereby considerably rarefied. The air flues, by which atmospheric air is admitted to the patent furnace, are so constructed as to intercept in a great measure, the radiation of heat, so that the air in the outer regions of the furnace, suffers very little rarefaction, and is therefore the more fit for supporting combustion.

Thirdly,—There is a great difference in their consumption of fuel to melt a given quantity of metal. A small patent furnace, melted at one time, five tons of metal, for which it did not require one ton of coke. It would have required about five tons of good pit coal, to have melted the same quantity in a reverberatory furnace. This is owing to the different way in which the metal is submitted to the action of heat in each (or in which the heat is applied in each.)

Fourthly,—The metal melted in the reverberatory, suffers materially in its quality. From the extended surface of melting and melted metal being exposed to the action of a passing flame, it is partially decarbonized, and is thus frequently rendered unfit for many kinds of castings. The metal in the bottom, or well, of the patent furnace, is protected by a quantity of small coke resting on its surface, so that when run into goods, it is of very superior quality to the former.

Fifthly,—The ordinary waste of metal, by the reverberatory furnace, is considerable. It may be averaged at 10 per cent. of the whole weight put into the furnace. The waste by the patent furnace does not exceed that by the cupola, which will rarely be so much as 5 per cent. This difference is principally attributable to the same cause as the difference in quality produced by the two furnaces.

Sixthly,—The patent furnace melts more metal in a given time than the reverberatory. The furnace from which the drawings are made has melted from 16 to 18. cwt. in one hour.

Seventhly,—In using the reverberatory furnace, unless the furnaceman be unremitting in his attention to the fire, &c. much damage may be sustained by the metal being converted into what is sometimes termed scull iron, or into a useless malleable state. On the contrary, if the patent furnace be but regularly supplied with fuel as the ignited mass descends, as in the case of the cupola, its operations will be uniform.

Eighthly,—The reverberatory furnace is very expensive to keep in repair. The interior of the furnace and chimney are liable to considerable wear by the action of the flame. The flame of the coke used in the patent furnace extends but a short way, and is not so destructive in its quality. Besides which, there is a much less surface exposed to the injurious effects of the fire, and no iron grate-bars, to renew.

Ninthly,—The smoke, and dense flame, frequently issuing far above the top of the reverberatory chimney, is truly terrific, as well as being very injurious, when situated in the middle of a town. Nor is it less dangerous and objectionable when on the sea coast. There is no such flame, or smoke, seen rising above the top of the chimney of the patent furnace.

The Patent Air-furnace, and Cupola, compared.

Firstly,—The cupola is supplied with air by mechanical means. It is consequently quite useless without its appropriate blowing machinery. The patent furnace although it resembles the cupola both in its mode of action and results, is nevertheless, *complete in itself*, requiring no blowing machinery, by reason of which its original cost is much less.

Secondly,—The cupola not only requires the appendages of blowing machinery, but there is also a mechanical power required to work it; sometimes steam-engine, or horse, or water power, is used. Hence, besides an additional expense for the steam-engine, horse, or water power, and intermediate machinery, &c. there is an immense and continual charge intailed upon its operations, for the production of the mechanical power. Nor is this less when manual labour is applied, which is sometimes done in small foundries. The patent furnace *requires neither steam-engine, water, nor animal power*, nor any machinery.

Thirdly,—The cupola is very costly to keep in repair. Its fabric in contact with the fire, is fast destroyed, thus incurring a perpetual consumption of expensive materials; in addition to which, there is also the wear and tear of machinery. The patent furnace is more durable, and has no machinery to be kept in repair.

Fourthly,—The operations of the cupola are necessarily liable to interruption by the failure of machinery, &c. From this disadvantage the patent furnace is exempt.

Fifthly,—The patent furnace is equally adapted for every situation where atmospheric air can have access to it; whereas, it often happens, that the most convenient place for the cupola is the least convenient for its machinery, so that sometimes the condensed air has to be conducted to a great distance by means of cast iron pipes. At other times there is a difficulty in obtaining the mechanical power, for want of water, &c.

Sixthly,—Although the metal from the cupola, is more suitable for many kinds of castings than that from the reverberatory furnace, having parted with less of its carbon in fusion than the latter, yet reverberatory metal is frequently preferred, when great strength is required. The patent furnace will not only, at all times, produce metal of the same profitable quality as that from the cupola, with the same materials, but it also retains the power of producing it of the same strong quality, as that from the reverberatory furnace, by merely allowing a less proportion of coke to remain on the melted metal whilst in the furnace.

Seventhly,—The coke, and metal, are put into the patent furnace alternately, *stratum super stratum.* As it descends, the metal is thus gradually brought in contact with the greatest heat that is excited in this furnace, as in the cupola. Yet it will generally be found, that the patent furnace will require a less proportion of fuel, to metal, than the cupola. This will be especially the case when a large quantity is melted at one time.

From the foregoing comparisons of the patent furnace with the reverberatory furnace and cupola, many of its great and important advantages as a melting furnace for cast iron, will be readily deduced. Afraid of trespassing too far on the invaluable pages of the Repertory, we have avoided entering so fully into the subject as otherwise might have been desirable. Therefore, the further appropriations of the patent furnace, must be the subject of future communications.

[*Repertory of Patent Inven.*

To Thomas Waller, *of Louton, in the County of Bedford, Straw Hat Manufacturer, for his invention of certain improvements in the manufacture of Straw Plait, for the purpose of making Bonnets, Hats, and other articles.*

These improvements in the manufacture of straw plait, for making bonnets, hats, &c. consist in the employment of the ordinary wheat straw grown in Tuscany, and other parts of Italy, instead of English straw, and which is plaited, twisted, or woven in the same manner as English straw, in order to produce similar kinds of straw fabric to those made of English straw, and commonly called or known by the names of whole Dunstable plait; double seven split straw plait; Luton twist plait; broad Luton twist plait; and double eleven split straw plait.

The mode of preparing the Tuscany or Italian straw, (which is not generally known here,) is by pulling the bearded wheat while the ear is in a soft milky state, the corn having been sown very close, and of consequence produced in a thin, short, and dwindled condition. The straw with its ears and roots, is spread out thinly upon the ground in fine hot weather, for three or four days, or more, in order to dry the sap; it is then tied up in bundles, and stacked, for the purpose of enabling the heat of the mow to drive off any remaining moisture. It is important to keep the ends of the straws air tight, in order to retain the pith, and prevent its gummy particles from passing off by evaporation.

After the straw has been about a month in the mow, it is removed to a meadow and spread out, that the dew may act upon it, together with the sun and air, and promote the bleaching, it being necessary frequently to turn the straw while this process is going on. The first process of bleaching being complete, the lower joint and root is pulled from the straw, leaving the upper part fit for use, which is then sorted according to qualities, and after being submitted to the action of steam, for the purpose of extracting its colour, and then to a fumigation of sulphur to complete the bleaching, the straws are in a condition to be plaited or woven into hats and bonnets, and are in that state imported into England in bundles, the dried ears of the wheat, being still on the straw.

The modes of preparing the said straw in Italy, however, forms no part of this invention, it is to be employed in the same state of preparation as when used for weaving, or plaiting that peculiar straw fabric, called Leghorn, and the patentee twists or weaves the said Italian straw, whether whole or split, in the same manner, as is commonly practised by the people in Bedfordshire and its neighbourhood, in making the above-mentioned whole Dunstable plait; double seven split straw plait; Luton twist plait; broad Luton twist plait, and double eleven split straw plait; the methods of making which, the patentee states, are so well understood by straw-plaiters, that any further explanation of the process is perfectly unnecessary.

The advantages of this invention are, that the Italian straw, from the mode in which it is prepared, is, when so plaited, much stronger than the English straw plait, and when sown together into the forms of hats, bonnets, and other articles, may be readily unsown without injury, and made up again into other forms, suitable to the prevailing fashion or fancy of the wearer; whereas the breadths of Leghorn plait, commonly made from the same materials, being nitted together at their edges, are not capable of being disunited and made up again into other forms.

The specification concludes, by saying—"Having thus stated my improvements, I wish to observe, that I do not profess to be the inventor of any of the several kinds of plait, above-mentioned, but I rest my claim of invention solely in the employment of Italian straw, for the plaiting, twisting, or weaving of similar kinds of fabric, to those heretofore made of English straw, whether whole or split, excepting the English imitations of Leghorn plait: none of the various plaits proposed to be made under this patent, having that sort of selvage, which is capable of being united together, but are all of them so to be plaited, that their edges must be united by sewing, as English straw plait always has been.—*Enrolled August*, 1826.

[*London Jour. of Arts.*

To Benjamin Newmarch, *of Cheltenham, in the County of Gloucester, gentleman, for his having discovered a preparation, to be used either in solution or otherwise, for preventing decay in timber, or other substances, arising from Dry Rot, and other causes.*

This invention, consists in introducing between the fibres of the wood, or into its pores, very minute particles of metallic and other poisonous matters, for the purpose of preventing the growth of vegetable fungi or animalcula. Dry rot in timber, according to the views of the patentee, arises from the decomposition of vegetable fluids, which all kinds of timber contain, and which in certain situations seem to be favourable to the propagation of fungi and of worms; it is also considered that neither animal nor vegetable germination, can proceed in contact with such mineral poisons, as the patentee proposes to employ, and therefore, in order to prevent the premature decay of timber by the growth of vegetable fungi, or of animalcula, the timber is to be treated in the following manner:—

Take one gallon of linseed, or any other kind of oil, (but linseed oil is preferred) and to this, add three ounces of sulphate of copper, or acetate of copper; three ounces of white arsenic; and three ounces of alum. These are to be boiled together, until the minerals are perfectly dissolved, and mixed with the oil. This mixture so prepared in any required quantity, is to be placed in a vessel suitable to receive the pieces of timber, about to be operated upon, which are to be immersed and boiled in the solution for three or four hours, or any other space of time, according to the thickness of the pieces of timber, observing, that they are required to be perfectly saturated with the solution, before they are removed. The pieces of timber having been thus treated, it is desirable that they should lie immersed in the solution until cold, in order that the pores of the wood may remain completely filled with the oil, and its mineral ingredients; but this is not absolutely indispensable, as the effect of merely boiling the timber in this solution, may be found sufficient to leave the pores filled with the mineral matters.

It is proposed that the mixture should be made in linseed oil, because that appears to be the most effectual solvent, that can be proposed as applicable to timber, as it is well known, that the excessive degree of heat requisite to bring linseed oil to the point of ebullition, exceeds that of almost every other fluid, consequently, the expansion which takes place in the pores of the timber on being boiled therein, together with the total destruction, or chemical change, of all the vegetable, or other corruptible matter, which the wood contained, and the replacing instead of them such antiseptic agents, as the acetic or sulphuric acids, in combination with copper, will entirely prevent the formation of vegetable fungi, or the propagation of animal life. The oxide of arsenic, is likewise known in a great degree to prevent vegetation, and is completely destructive to animal life; and it is also known that these compounds readily combine in solution, and are when incorporated with such an impervious and adhesive agent as boiled linseed oil, rendered indestructible, in most ordinary situations, for any length of time, except when attacked by fire. The alum likewise is calculated to take up that partial kind of moisture which may be floating in the surrounding atmosphere, but its presence may be dispensed with, when the timbers are likely to be immersed in water.

The patentee states, that though he mentions the proportions in which he prefers to mix the several ingredients above named, yet he wishes it to be understood, that he does not confine himself to the use of those exact proportions, but only mentions them as the best that he at present knows of, to effect the object; and though he has described those minerals, as entering into solution with the oil, yet he does not mean to confine himself strictly to the term solution chemically considered, as the said minerals may be blended or mixed with the oil, in a manner that would answer the purpose without absolutely entering into solution: that is, the said ingredients may be mixed by grinding, and be applied to wood in the nature of paint.

The patentee further recommends the employment of charcoal in various situations, for the prevention of dry rot in timber, by introducing it in a dry state, between confined timbers, where the circulation of air is impeded, especially between the plankings of the decks of ships, and in various other situations, as charcoal would be found particularly beneficial on ship board, from its antiseptic and purifying qualities, and in conclusion says; "I wish it to be understood, that I claim as my invention the above preparation and process for preventing the destructive effects of dry rot, and worm on timber, (viz.) the boiling of timber in oil, which has been impregnated with the mineral substances above named, and which preparation may be also usefully employed in preventing decay in various other substances beside wood."—*Enrolled Aug.* 1826. [*Ib.*

To George Augustus Lamb, *of Rye, in the County of Sussex, Doctor of Divinity, for his invention of a new composition of Malt and Hops.*

The patentee proposes to make an extract from malt, and hops, which shall contain, not only the saccharine and bitter parts of the ingredients, but also the essential oil of the hops, and retain the flavour so as to be capable by the addition of water and yest, of being fermented into beer.

The mode of making this extract, is, by infusing the hops in warm water, in the proportion of one pound of hops, to two gallons of water, and then submitting this infusion to the process of distillation, so as to obtain the essential oil of the hops, which will be produced in the proportion of about three ounces of the essential oil, from fifty pounds of good hops. After this has been done, the remaining liquor is to be strained off from the hops, by pressure, and the extract thus obtained, evaporated, until fifty pounds weight is reduced to fifteen, and when perfectly cold, three ounces of the essential oil of the hops, is to be mixed with fifteen pounds of the evaporated extract.

The malt is to be submitted to infusion, in the usual way, and the extract obtained, evaporated, until the produce of one bushel of good malt, shall be reduced to twenty-three pounds. When cold, the two extracts prepared as above described, are to be mixed together, in an earthen or wooden vessel, in the proportion of one thousand, one hundred and fifty pounds weight, of the evaporated extract of malt, to fifteen pounds of the compound extract of hops; or if intended to be sent to sea, twenty-two pounds of the extract of hops, are to be mixed with the above-mentioned quantity of the malt extract.

This mixture may be kept in stone jars or bottles, carefully excluded from the air, and may be fermented into beer, as occasion shall require, by the addition of small quantities of yest. For small beer, one pound of the mixed extract, should be incorporated with one gallon of water; for table ale, one pound and a half must be employed, and for strong ale, two pounds of the extract, to the same quantity of water. In summer time, water at the natural temperature, may be used, but, when the weather is cold, the water should not be below 72° Fah.—*Enrolled Aug.* 1825. [*Ib.*

FRENCH PATENTS.

Brevet, for five years, granted to M. le Coffre, *for pressing rollers of leather, without seams, for the use of cotton-spinning factories.* Dated April 21, 1818.

The leather employed for making these rollers, is either neats or calf-skin, tanned and passed through oil, to make it more flexible and elastic.

Circles of this leather are cut out by a double punch, and run upon an iron axle of an octagonal form, where they are strongly pressed together between two disks of metal, one of which is soldered to the axle, and the other, which is a screw or nut, may be screwed tighter, or unscrewed, as desired. These rollers are then turned, and reduced to a convenient diameter.

It will be perceived on examining p. 265 of the second volume of our present series, that the rollers which Mr. Philip Chell uses in his patent spinning machinery, and the right to which he expressly claims as being one of his inventions, are precisely made as those above described.

But though M. Coffre has anticipated Mr. Chell five years in the invention, this having been done in a foreign country cannot by itself invalidate the claim of the latter gentleman; and from the circumstance of the account of M. Coffre's brevet not having been published in France before last year (1825,) we think it very probable that Mr. Chell never heard of M. Coffre's invention, and that the same contrivance may have actually occurred to both; a matter not so unfrequent among ingenious persons as many suppose.

[*Repertory of Patent Inven.*

Brevet, for five years, granted to MADEMOISELLE JULIE MANCEAU, *of Paris, for a process for making with raw silk, hats imitating the Italian (or Leghorn) straw hats.* Dated April 16, 1818.

The raw silk, being chosen of the finest quality, is to be first formed into narrow flat pieces (like very narrow tape,) and dyed; and the dyer is to gum them so that they may have a stiffness approaching that of straw or the bark of a tree; then these narrow pieces are to be plaited by a plaiting machine, into bands more or less fine, and more or less close, according to the fineness which is desired to be given to the hats. The plaited bands, are examined carefully through their whole length, in order to cut out the defective parts, which might injure the evenness of the work.

These plaited bands, thus prepared, are measured, rolled into balls of a convenient quantity, and given to work-people to put them together, which is done with a needle, and silk twist of three filaments, of the same colour as the plait.

The concealment of the sewing, is obtained by fastening the left side of the plait, to the right side of that which has been before put together, in such a manner, that the sewing forming a *zigzag* as much at one side as at the other, will be hidden, at all the points of contact. These hats are made in two pieces, the cap (or crown) and the brim.

The first piece is began at the centre, and the points of connexion are combined in such a manner that, in proportion as the circumference increases, the spiral which the sewing forms, may be developed and connected together without being puckered. This crown ought to be made of a single piece of plait.

The brim is formed in the same manner; the being accustomed to the sewing will enable the eye to determine the most graceful *contours* and best forms in this work. This part, made likewise of a single piece of plait, is united to the crown in order to be gummed, and along with it, to form the hat.

The gum is composed of ten parts of gum tragacanth, one part of alum, and nine parts of water, which being brought to a state of mixture by heat, the work is plunged into it until it becomes saturated, and then is left to become partially dry, and to be deprived of its excess of moisture so as to be in a fit state for being pressed, and smoothed with a hot iron.

For this purpose according to the form required for the crown, a cylinder, or any other solid of wood is used, composed of several pieces, pierced in the middle by an aperture, for the purpose of receiving a piece of wood of a conical shape. This cylinder being placed within the crown, the pressure of the conical piece passing into the centre of the mould, will determine the tension of the stuff, which is then smoothed with a hot iron, the size and form of which are suitable to those of the object on which it is to be employed.

If instead of raw silk it is preferred to use hair, the hats are to be formed of it in the same manner.

These new hats are lighter than those of Italian straw, and they may be washed, and re-dyed of different colours.

CERTIFICATE OF ADDITIONS.

The first materials, which were raw silk ; are to be replaced with hair *(poils d' alés)* which has the advantage of rendering the tissue finer without producing any inequalities, and of affording more agreeable shades of colour.

The hats which were formerly made of two pieces, are at present made of a single piece, by the continuation of one length of plait.

The first sort of stiffening had the inconvenience of leaving spots in drying, which is avoided by employing prepared gum tragacanth ; and for the second stiffening, a varnish composed of mastic, in tears, to render the hats water-proof.

The smoothing is performed by a mechanical press, which at the same time that it presses the hats, gives them a gloss which they could not obtain from the iron.

Men's hats may be made by the same process. [*Ibid.*

Antiquity of Steam Vessels.

A work has lately been published in Spain, by one of the secretaries of the king, and printed at the royal press ; containing original papers, relating to the voyages of Columbus, which had not previously been published, and which have been collected with great care, from the ancient archives, and libraries, of Spain.

The following remarkable statement, appears as a note, in the first volume of the work. It will be seen, that it ascribes the invention of the steam-boat to a Spaniard, nearly three hundred years ago. We copy this article, from the last number of the North American Review, the editor of which, has translated it from the original.

Circumstantial as is the account given, we confess, that it appears to us, to have been written since the days of Fulton. "This statement, was communicated to the author, in a letter from *Thomas Gonzales*, dated at Salamanca, the twenty-seventh of August, 1825; and, it would appear, that he had recently consulted the public records, to which he refers."

When these 'public records,' shall appear in an authentic form, their evidence must be admitted, but until then, we shall not be inclined to commence the history of the invention of the steam-boat, so far back as the year 1543.—*Editor.*

'Blasco de Garay, a sea captain, exhibited to the emperor and king, Charles the Fifth, in the year 1543, an engine, by which ships and vessels of the largest size, could be propelled, even in a calm, without the aid of oars or sails.

'Notwithstanding the opposition which this project encountered, the emperor resolved, that an experiment should be made, as in fact it was with success, in the harbour of Barcelona, on the seventeenth of June, 1543.

'Garay never publicly exposed the construction of his engine, but it was observed at the time of the experiment, that it consisted of a large caldron or vessel of boiling water, and a moveable wheel attached to each side of the ship.

'The experiment was made on a ship of two hundred tons, arrived from Colibre, to discharge a cargo of wheat at Barcelona; it was called the Trinity, and the captain's name was Peter de Scarza.

'By order of Charles the Fifth, and the prince, Philip the Second, his son, there were present at the time, Henry de Toledo, the governor Peter Cardona, the treasurer Ravago, the Vice Chancellor Francis Gralla, and many other persons of rank, both Castillians and Catalonians; and among others, several sea captains witnessed the operation, some in the vessel, and others on the shore.

'The emperor and prince, and others with them, applauded the engine, and especially the expertness with which the ship could be tacked. The treasurer, Ravago, an enemy to the project, said it would move two leagues in three hours. It was very complicated and expensive, and exposed to the constant danger of bursting the boiler. The other commissioners affirmed that the vessel could be tacked twice as quick as a galley, served by the common method, and that at its slowest rate, it would move a league in an hour.

'The exhibition being finished, Garay took from the ship his engine, and having deposited the woodwork in the arsenal of Barcelona, kept the rest himself.

'Notwithstanding the difficulties and opposition thrown in the way by Ravago, the invention was approved, and if the expedition, in which Charles the Fifth was then engaged, had not failed, it would undoubtedly have been favoured by him. As it was, he raised Garay to a higher station, gave him a sum of money (200,000 maravedies) as a present, ordered all the expenses of the experiment to be paid out of the general treasury, and conferred upon him other rewards.

'Such are the facts collected from the original registers, preserved in the royal archives at Samáncas, among the public papers of Catalonia, and those of the secretary at war, for the year 1543.'

ON ENGRAVING.

(FROM THE MECHANICS' GALLERY. BY C. F. PARTINGTON.)

(Continued from page 204.)

On Aqua tinta.

Aqua tinta, is a method of producing prints, very much resembling drawings in Indian ink.

The principle of the process, consists in corroding the copper with aqua fortis, in such a manner, that an impression from it, has the appearance of a tint laid on the paper. This is effected, by covering the copper with a powder, or some substance, which takes a granulated form, so as to prevent the aqua fortis from acting where the particles adhere, and by this means, causes it to corrode the copper partially, and in the interstices only. When these particles are extremely minute, and near to each other, the impression from the plate, appears to the naked eye, exactly like a wash of Indian ink; but, when they are larger, the granulation is more distinct, and as this may be varied at pleasure, it is capable of being adapted with great success, to a variety of purposes and subjects.

This powder, or granulation, is called the *aqua tinta grain*, and there are two general modes of producing it.

We shall first describe what is called the *powder-grain*, because it was the first that was used.

Having etched the outline on a copper-plate, prepared in the usual way by the coppersmith, some substance must be finally powdered and sifted, which will melt with heat, and when cold, will adhere to the plate, and resist the action of aqua fortis. The substances which have been used for this purpose, either separately or mixed, are, *asphaltum*, *Burgundy pitch*, *rosin*, *gum-copal*, *gum-mastich;* and, in a greater or less degree, all the resins and gum-resins, will answer the purpose. Common rosin, has been most generally used, and answers tolerably well; though gum-copal makes a grain that resists the aqua fortis better.

The substance, intended to be used for the grain, must now be distributed over the plate as equally as possible; and different methods of performing this essential part of the operation, have been used by different engravers, and at different times.

The most usual way, is to tie up some of the powder in a piece of muslin, and strike it against a piece of stick, held at a considerable height above the plate; by this, the powder that issues, falls gently, and settles equally over the plate. Every one must have observed, how uniformly hair powder settles upon the furniture, after the operations of the hair-dresser. This may afford a hint, towards the best mode of performing this part of the process. The powder must fall upon it from a considerable height, and there must be a sufficiently large cloud of the dust formed. The plate being covered equally over with the dust, or powder, the operator is next to proceed to fix it upon the plate, by heating it gently, so as to melt the particles. This may be effected, by holding under the plate lighted pieces of brown paper, rolled up, and moving them about, till every part of the powder is melted; this will be known by its change of colour, which will turn brownish. It must now be suffered to cool, when it may be examined with a magnifier, and if the grains or particles, appear to be uniformly distributed, it is ready for the next part of the process.

The design or drawing to be engraved, must now be examined, and such parts of it as are perfectly white, are to be re-marked. Those corresponding parts of the plate, must be covered, or stopped-out, as it is called, with turpentine-varnish, diluted with turpentine to a proper consistence, to work freely with the pencil, and mixed with lamp-black, to give it colour; for if transparent, the touches of the pencil would not be so distinctly seen. The margin of the plate, must also be covered with varnish. When the stopping-out is sufficiently dry, a border of wax must be raised round the plate, in the same manner as in etching, and the aqua fortis properly diluted with water poured on. This is called biting-in, and is the part of the process, which is most uncertain, and which requires the greatest degree of experience. When the aqua fortis has lain on so long, that the plate, when printed, would produce the lightest tint in the drawing, it is poured off, and the plate washed with water, and dried. When it is quite dry, the lightest tints in the drawing, are stopped out, and the aqua fortis poured on as before, and the same process is repeated as often as there are tints to be produced in the plate.

Although many plates are etched entirely by this method of stopping-out and biting-in alternately, yet it may easily be conceived, that in general, it would be very difficult to stop round, and leave out all the finishing touches, as also the leaves of trees, and many other objects, which it would be impossible to execute, with the necessary degree of freedom in this manner.

To overcome this difficulty, another very ingenious process has been invented, by which these touches are laid on the plate with the same ease and expedition, as they are in a drawing of Indian ink. Fine washed whiting, is mixed with a little treacle or sugar, and diluted with water in the pencil, so as to work freely, and this is laid on the plate, covered with the aqua tint ground, in the same manner, and on the same parts as ink on the drawing. When this is dry, the whole plate is varnished over, with a weak and thin varnish of turpentine, asphaltum, or mastich, and then suffered to dry, when the aqua fortis is poured on. The varnish will immediately break up in the parts, where the treacle mixture was laid, and expose all those places to the action of the acid, while the rest of the plate, remains secure. The effect of this will be, that all the touches or places, where the treacle was used, will be bit-in deeper than the rest, and will have all the precision and firmness of touches in Indian ink.

After the plate is completely bit-in, the bordering wax is taken off, by heating the plate a little with a lighted piece of paper; and it is then cleared from the ground and varnish by oil of turpentine, and wiped clean with a rag, and a little fine whiting, when it is ready for the printer.

The principal disadvantages of this method of aqua-tinting, are, that it is extremely difficult, to produce the required degree of coarseness or fineness in the grain, and that plates so engraved, do not print many impressions before they are worn out. It is therefore now very seldom used, though it is occasionally of service.

We next proceed to describe the second method of producing the aqua tint ground, which is generally practised. Some resinous substance is dissolved in spirits of wine, as common rosin, Burgundy-pitch, or mastich, and this solution is poured all over the plate, which is then held in a slanting direction, till the superfluous fluid drains off; and it is laid down to dry, which it does in a few minutes. If the plate be then examined with the magnifier, it will be found, that the spirit, in evaporating, has left the resin in a granulated state, or rather, that the latter has cracked in every direction, still adhering firmly to the copper.

A grain is thus produced with the greatest ease, which is extremely regular and beautiful, and much superior for most purposes, to that produced by the former method. After the grain is formed, every part of the process is conducted in the same manner, as above described.

(TO BE CONTINUED.)

ESSAYS ON BLEACHING.

By James Rennie, A. M. Lecturer on Philosophy, &c. &c. London.

No. 1.—HISTORY OF THE ART.

SECTION III.—A still greater improvement in this art, was made between twenty and thirty years subsequent to Dr. Home's publication, on the application of chlorine to bleaching. The manufacturer is indebted to the distinguished French chemist, Berthollet, for the addition of so important and powerful an agent to his apparatus. This substance was discovered by Scheele, in 1774. Its property of destroying vegetable colours, was soon after ascertained by the illustrious discoverer, and detailed experiments on this property, were given by him in the Transactions of the Swedish Academy of Sciences, of which papers of Scheele, we have a translation by Dr. Bed-does. This property, excited a lively interest among the chemists of the day, and gave rise to many ingenious experiments, besides those of Scheele, most of which, appeared to be more amusing to philosophic curiosity, than useful, in the advancement of so important an art as bleaching. But such experimental amusements, are seldom destitute of utility, and important results, even though at first sight, they may appear to be fanciful or trifling. The wild dreams of the Alchymists, laid the foundation of the most interesting of the sciences, and lighted a torch, which the splendid discoveries of our contemporaries, have kindled to a blaze; the speculative experiments, which were made on chlorine, merely to gratify a passion for chemical research, have been turned to advantageous account, in an important branch of our manufactures. It was no less than ten years after the discoveries of Scheele, that chlorine was applied to practical bleaching. The first account of this application is given by Berthollet, in the Journal de Physique, for 1785, and in the Annales de Chemie, tome I. From the details there given, and from papers published by the same chemist, in the years immediately succeeding, we learn that the mode of bleaching by chlorine, was carried on to a considerable extent in various parts of France.*

The history of the introduction of Berthollet's method into Britain, has given rise to some disputes, which I think it of some importance, though of some difficulty, to settle. Parkes states, on the authority of Professor Copland of Aberdeen, and the present Duke of Gordon, that, when travelling on the Continent, they learned the process from Saussure of Geneva. The Professor, foreseeing the advantage which his countrymen would derive from a knowledge of this, made himself master of the requisite manipulations, and immediately on his return, communicated the important information to several bleachers at Aberdeen. This was so early as July, 1787, but two years subsequent to the invention of the method. The Aberdeen bleachers, first used a Woolfe's apparatus, but the inconvenience of glass vessels, in extensive works, obliged them to have recourse to those made of white wood. This seems to have been the first introduction of Berthollet's method into Britain. It was not till the following year, that Mr. Watt of Birmingham, was instructed by Berthollet himself in the art, which, without impropriety, might then be called new, so complete was the revolution caused by this useful invention.† Mr. Watt was impressed with the importance of the improvement, entered upon experiments with all the enthusiasm of genius, and actually applied it to practice, by bleaching 1500 pieces of cloth, a circumstance, which he mentions in the above-mentioned letter: but he did not persevere in the practice of the art, owing, most probably, to his local distance from the seat of the cotton and linen manufactories. But the knowledge of the process, which had been acquired by Mr. Watt, was not lost. He communicated a portion of his own enthusiasm to several scientific and enterprising persons about Manchester, who entered with keenness, and alacrity, upon the practice of bleaching by chlorine. In Rees' Cyclopedia, it is said, that the Manchester bleachers, as well as Mr. Watt, received their information from Kirwan, who is there said to be the original suggestor. Be this as it may, the year 1788 had not elapsed, when Dr. Taylor, and Mr. Cooper of Manchester, bleached, for the purpose of experiment, a piece of cotton goods by this process, had it printed, calendered, and fit for the market, in less than three days. Exulting in the success of his experiment, Mr. Cooper, together with several other enterprising manufacturers, commenced a bleaching work at Raikes, near Bolton, where Berthollet's discovery was applied, on a very extensive scale. We are informed by Mr. Parkes, that, in these works, there is at present (1815) consumed many tons of sulphuric acid every week. Mr. Henry of Manchester, not only formed a similar establishment, which his increasing practice in medicine, and the dishonourable conduct of a partner, obliged him to abandon, but generously instructed the principal bleachers in this country in the method, of which, at this period, there was no practical account published. The method of Mr. Henry at first consisted, sometimes of immersing the goods in a watery solution of the gas, or in an alkaline ley impregnated with it; and sometimes in exposing the goods, previously moistened with water, to the action of the gas itself. Soon afterwards, he made a farther improvement, in substituting lime for alkali, as a means of condensing the gaseous chlorine, which was exclusively applied to white goods. An air-tight chamber was constructed, on the floor of which, was spread a stratum of lime, mixed with water to the consistence of cream. Through this, the goods were passed by means of a wince, and the chamber being filled with gas, the goods were exposed alternately to the calcareous liquid, and the acid vapours. An oxymuriate of lime was thus formed on the surface of the cloth, which, after the operation had continued for a sufficient length of time, was taken out, and exposed to the usual processes of washing, crofting, and finishing.

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* It is somewhat ridiculous, to observe it stated in Rees' Cyclopedia, (Art. Bleaching,) that the first practical application of chlorine, was made in the Spring of 1788, in London, at the suggestion of Dr. Kirwan, who had learned the decolourizing property of the substance, directly from Scheele.

† Since the publication of Mr. Parkes' Essays, however, this statement has been corrected by Dr. Henry, in a letter to Dr. Thomson, dated Oct. 1815. From this it appears, that Mr. Watt was acquainted with Berthollet's discoveries, so early as the beginning of 1787, as he expressly says in a letter, dated Feb. 23, 1788, "I have, *for more than a twelvemonth*, been in possession and *practice* of a method of preparing a liquor from common salt, which possesses bleaching qualities in an eminent degree; the inventor is an eminent chemist and philosopher at Paris." (Ann. Phil. VI. 423, in a note.) This, therefore, must have been several months prior to the commencement of the works at Aberdeen.

Early in the year 1788, an attempt was made in England by some foreigners, De Bonnevil & Co. who had modified the plan of Berthollet, to obtain a parliamentary grant for the discovery of a new method of bleaching; and failing in this, to obtain a patent right for their pretended discovery. Mr. Watt, however, who had previously been made acquainted with Berthollet's discovery, resisted this monopoly, and was joined by Mr. Cooper and Mr. Henry, whose successful experiments, we have already mentioned. An opposition from so respectable a quarter, was effectual, and the foreigners were foiled in their attempt to obtain a grant. Mr. Henry, individually, presented a legal petition in due form, against the patent, and was successful in opposing it. His petition, dated July 2, 1788, contains every thing at present known, relative to bleaching, except the condensation of chlorine by means of lime, a thing which he afterwards accomplished, (see Ann. Phil. VI. 424.) The agent, which these foreigners employed in their process, they called Liqueur de Janelle, from the name of their native place. It was prepared by receiving the gas, which arises from the distillation of three pounds of muriate of soda, and one pound of manganese, into a receiver, containing one pound of the best American pearl ash, dissolved in four pounds of water. For the purpose of extricating the gas from these materials, two pounds of sulphuric acid, diluted with four pounds of water, were held to be sufficient. I am not quite sure if the inventors of this liquid, have received all the praise which is due to them. It is certain, that they did not learn the process from Berthollet, as he only found it out by analyzing the liquid prepared by them.

Next year, 1789, Berthollet published in the Annales de Chemie, a very circumstantial account of the system, with ample directions for the construction of the apparatus. From this it appears, that gas bleaching, was now adopted in various parts of France, and would have been universally employed, but for want of a convenient, and safe mode, for its production, and application. These obstacles, Berthollet subsequently overcame by the most ingenious inventions of apparatus, of which he has published an account in the Annales de Chemie. Previous to this, gas bleaching was conducted in England, upon a very imperfect method, and the manufacturers were ignorant of any other mode of using the chlorine, except in the gaseous state. At Nottingham, for instance, small parcels of linen yarn, linen and cotton hose, and the like, were bleached by being suspended within large wooden boxes, each of which had a close bottom, capable of holding water. Into these, gas was conveyed, and, to prevent any injury by its immediate application, the goods were, by means of a frame and pulley, frequently let down into the water at the bottom; by which method, it was difficult to get all the surfaces of the goods equally exposed, without which, bleaching must always be imperfect. This mode, however, was ingeniously improved by Mr. Rupp, of Manchester, who has given a plate, and a description of his apparatus, in the 5th vol. of the Manchester Memoirs.

(TO BE CONTINUED.)

ANCIENT VASES.

(Continued from page 226.)

From an accurate examination, it appears probable that the thin pellucid coating, by which the colour of the clay is rendered brighter, or duller, is of the same substance with the black paint of vases, but in a diluted or attenuated state, which was first shown by the celebrated Jorio, the very learned Inspector of the Royal Collection of Vases at Naples. It may commonly be observed in vases, that this paint has been repeatedly applied, where the colour of the clay had not been completely modified by the first operation, and in this manner also the colour has been changed from dusky, to black. Sometimes single lines occur, in which different degrees of intensity may be observed in the colour.

We shall now inquire into the nature of this black paint. Caylus has ascribed the black varnish to the martial or manganesian earth of glass-works, an opinion which Grivaud has also embraced. Le Sage once thought, that the black coating of vases, was produced from oxide of lead, and oxide of manganese, which opinion is not only sufficiently confuted by what I have said above, with regard to the nature of the varnish, but also by the slight degree of baking which the vases have undergone, by which the oxide of lead could not be applied, as Chaptal has also remarked. Scheerer says, that the coating of vases does not consist of metallic substances, but of a certain kind of earth, and that the black colour cannot have been produced by oxide of manganese. Chaptal inclines to the opinion, that vitreous lava has formed the basis of the coating of vases, its natural fusion having been strongly assisted, by the addition of some saline substances. Vauquelin was the first who discovered that the black paint was carbonaceous, and he is at the same time of opinion, that it was prepared from graphite or anthracite.

From experiments made with the view of investigating this matter, I too have found that the black coating of vases consists of a combustible substance, either carbonaceous or bituminous; with this determination, the above-mentioned experiments also agree, inasmuch as it is not dissolved by acids. On throwing particles of the black coating, into nitre, fused in a platina cup, they burned by sparkling, and were quickly consumed. By this experiment, the singular phenomenon, that a coating so thin should have preserved its colour, and lustre, for so long a period, is satisfactorily explained.

The question, regarding the substance from which this black coating has been derived, is more difficult of solution. I cannot give my assent to the opinion of the celebrated Vauquelin, mentioned above. It is shown, by the colour and lustre of the paint, that it could not have been prepared from graphite, a substance which has more of the colour of iron, and a metallic lustre. The quality which it possesses of fusing with nitre, as above related, is also against its derivation from graphite and anthracite. If we suppose the paint to have been laid on with a pencil, it may be inferred that its substance had been fluid of itself, or had been reduced to a state of fluidity, by means of some other substance. As the appearance of the coating of vases proves its fusion, it may be concluded that the matter was either fusible of itself, or had been rendered so, by intermixture with some other substance. Nor does it seem improbable, that, in order to form this coating, a substance was applied, which either occurred in the different countries in which those vases were manufactured, or was easily procured by commerce.

I instituted various experiments, with the view of determining this substance, which entirely failed, because I followed the common opinion, that the black coating of the antique vases, was laid on, and burnt in, in the same way as the pigments are, in the manufacture of our better sorts of earthen-ware. I applied various carbonaceous substances, vegetable as well as mineral, reduced to a sufficient degree of tenuity by levigation, either by themselves, or by means of a fluid, or mixed with fusible substances, to vessels either dried in the air, or baked, and these I exposed, after inclosing them in other vessels, to various degrees of heat, in a pottery-furnace. These vessels so coated, came, without exception, from the furnace, with red, yellow or white colours, according to the quality of the clay, and the different degrees of heat. I applied liquid bitumen in other experiments, but with no better success.

When I had almost despaired of accomplishing my object, it occurred to me, that perhaps the method which is used for covering iron-work with a black coating, might be equally applied to earthen-ware. The experiments, in which I made use of mineral bitumen, succeeded very well. I dissolved asphaltum in naphtha or mineral oil, and applied the solution, by means of a pencil, to earthen vessels once baked and again heated, by which a black coating, like varnish, intimately attached to the surface of the vessels, and precisely similar in appearance to the black coating of the ancient Grecian vases, was immediately produced. The degree of heat at which the solution is to be applied, should be such as is sufficient for melting the asphaltum. I exposed the vessels, after the coating was laid on, for some time to heat, by which the naphtha is evaporated, and the varnish is completely dried. Liquid bitumen, applied in the same manner, gives a similar, but less bright, varnish. The solution of asphaltum by means of naphtha, is also preferable on this account, that very different degrees of saturation may be produced. A thin solution, affords a transparent varnish, by which dusky colours are produced, passing more or less into red, according to the different colour of the clay. If the application of this solution be repeated, very different varieties of varnish may be produced, from a brown colour, to a perfect black. If a saturated solution be applied, a dull black colour is produced, at once.

In the same way that the surface of vessels is covered over with varnish, various figures are painted upon it, by means of a pencil. The paintings may be made more perfect, in proportion to the degree of heating, which the vessel undergoes; for the varnish enters in this manner, the sooner into the pores of the clay, and loses its fluidity, on which account the delineations are more distinct. But the more the vessels are heated, the more quickly must the paintings be applied.

As it is only the outside that requires to be covered with varnish, or paintings, vessels may easily be heated for this purpose, by filling them with burning charcoal, or hot embers. But if vessels having little depth, are to be painted within, they must be previously heated in a proper furnace, or among hot cinders.

(TO BE CONTINUED.)

FOR THE FRANKLIN JOURNAL.

Description of a new Scale and Protracter, invented by M. Twitchell.

The editor of the Franklin Journal, will oblige me, by inserting the following description of my scale and protracter.

This instrument consists of a circle, marked with the lines of sines, tangents, secants, semitangents, and chords; to the centre of which circle, is annexed a scale of the shape of half a cross, agreeing with the line of chords on the circle, and marked on each limb, with the line of equal parts; the cross limb of this scale, consists of two parts; to one of which is annexed a semicircle, marked with the line of chords, the other part, turning on its centre, and agreeing with the line of chords on the semicircle, serving both as a protracter and scale. To the centre of the whole circle, is annexed, a small limb, agreeing with the line of chords on the circle, and extending over the scale, and serving as a secant to the circle. This scale, exhibits the use of chords, sines, secants, and tangents, and the mode of applying them to angles, giving the sides, and chords, of any triangle, and also, its sine, tangent, and secant; and likewise, latitude, departure, course, and distance. For drafting, this scale is particularly useful; for in plotting, nothing more is required, than to turn the scale to the course, and mark the distance.

Among the numerous recommendations received, are those of B. Hallowell, and C. Farquhar, principals of Alexandria boarding-school; James D. Woodside, math. prof.; William Thornton, of the patent office; John M. Moore, of the gen. land-office; C. Schwartz, draftsman of the navy board; brig. gen. Bernard, of the board of engineers, and William Strickland, civil engineer.

MARK TWITCHELL.

The editor has examined the instrument above named, and is of opinion, that in addition to the purposes indicated, it would be found particularly useful in teaching trigonometry, as it renders the relationship of the angles, objects of sense.

List of New Patents, in England, which have passed the Great Seal since July 24, 1826.

James Barron, for a combination of machinery or apparatus for feeding fire with fuel, which machinery or apparatus is applicable to other purposes. Dated July 24, 1826.

William Johnston, for improvements on ink-holders. Dated July 24, 1826.

William Robinson, for a new method of propelling vessels by steam on canals or navigable rivers, by means of a moveable apparatus attached to the stem or stern of the vessel. Dated July 24, 1826.

William Parsons, naval architect, for improvements in building ships or vessels, which improvements are calculated to lessen the dangerous effects of internal or external violence. Dated July 24, 1826.

William Davidson, Glasgow, for processes for bleaching or whitening bees' wax, myrtle wax, and animal tallow. Dated August 1, 1826.

Thomas John Knowlys, Esq. and William Duesbury, collar manufacturer, for improvements in tanning. Dated August 1, 1826.

Count Adolphe Eugene de Rosen, for a new engine for communicating power to answer the purposes of a steam-engine. Communicated by a foreigner. Dated August 1, 1826.

Joseph Browne Wilks, Esq., for improvements in producing steam for steam-engines, and other purposes. Dated August 2, 1826.

Lemuel Wellman Wright, engineer, for improvements in the construction of trucks or carriages, applicable to useful purposes. Dated August 2, 1826.

John Williams, and John Doyle, for an apparatus and process for separating salt from sea water, and thereby rendering it fresh and fit for use. Dated August 4, 1826.

Erskine Hazard, of North America, but now residing in Norfolk-Street, Strand, engineer, for a method or methods of preparing explosive mixtures, and employing them as a moving power for machinery. Partly communicated to him by a foreigner. Dated August 12, 1826.

John Thomas Thompson, camp-equipage-maker, for improvements in making or manufacturing metallic tubes, whereby strength and lightness are obtained, and for applying them, with various other improvements, to the constructing of the metallic tube, and other bedsteads. Dated August 17, 1826.

List of Patents issued in the United States, from the 2nd to the 30th of Aug. 1826.

To James Barron, of Virginia, for an improvement, denominated the carrying and lifting dock; for building and repairing vessels, August 2nd.

To Henry Bostwick, of New York, for a method of representing by lines, consistent with a scale of time, the kindred, genealogy, chronology, and succession of persons, distinguished in history or fable, August 2nd.

To Cotton Foss, of Ohio, for the application of steam, to the blast of furnaces; called a steam power furnace, August 2nd.

To Elisha Crowell, of Maine, for a method of moving the trip hammer, August 4th.

To H. Branch, of New York, for a mode of turning any number of augers, centre-bits, &c. in making mortices of any dimensions or proportions, August 7th.

To John A. Smith of Connecticut, for an improved mode of elevating liquors, from a lower to an upper room, August 7th.

To Z. S. Holdridge, and H. S. Lawson, of New York, for an improvement in the plough, August 9th.

To S. Lehman, of Philadelphia, for an improvement in the fire-ladder, August 9th.

To J. Hines, and W. Bain, of New York, for dressing flax, or hemp, rolled, or unrolled, August 12th.

To Joseph H. Laning, of Tennessee, for a method of working steam, twice over, or working two steam-engines, with the same steam, August 12th.

To Joseph Hastings, of Massachusetts, for a method of making lamp-black, August 15th.

To Joseph Clarkson, of Baltimore, for a machine for laying, and twisting cotton, and other cords, August 16th.

To Thomas Van Riper, of New Jersey, for a trussel bobbin, or spool, to be used in spinning factories, August 16th.

To Joseph Eve, of England, for an improvement in steam-enginery, August 16th.

To William Burton, of New York, for a machine for washing clothing, or cloth, August 16th.

To Joseph H. Schreiner, of Philadelphia, for an improved auger, August 17th.

To John Floyd, of Maine, for a floating dry-dock, called Floyd's floating machine, for lifting ships, or vessels out of the water, for the purpose of repairing them, August 19th.

To Benjamin Wilse, of New York, for improved suspenders, August 19th.

To Z. Parkhurst, of Massachusetts, for a substitute for oil, and which may be mixed with oil in proper proportions, and applied to wool, before carding, August 19th.

To Joseph H. Schreiner, of Philadelphia, for a mode of setting saws, August 19th.

To J. R. Wheeler, and J. B. Wheeler, of New York, for a machine for roping and spinning wool and cotton, August 28th.

To William H. Cantelo, and Robert M. Kerrison, of New York, for a *Jubilee Stock*, August 30th.

NOTICES.

FRANKLIN INSTITUTE.

Lithography.—A communication has appeared in the Boston Commercial Gazette, in which it is stated, that Messrs. J. & W. Pendleton, of that city, to whom the Silver Medal of the Institute, was awarded, for the best specimen of LITHOGRAPHY, are only *lithographic printers*, and not artists. As the Institute has not heretofore demanded certificates of origin, with articles deposited, such an error may have been committed; but we doubt not, that measures will be taken, to prevent the recurrence of a similar event. Of the correctness of the above statement, we have not any other information, than that which appears in the communication, to which we have alluded.

Auger for boring square holes.—It is now said, that Mr. H. Branch, of New York, is not the inventor of this auger; he however, represented himself as such, to the committee on inventions, whose report on this instrument, is in our last number. It is also said, that Mr. Cyrus Jenkins is "the true inventor," and that Mr. Branch, has a third rate right, by purchase, and that he has since obtained a patent, for "turning any number of augers" at once. We have neither time, or inclination, to enquire into the validity of such claims, we however, wish "honour, to whom honour" is due. We think, that some of our *patent-mongers*, give a very broad construction to the words "true inventor."

To Subscribers.—The subscription for this Journal, was due on the 1st of June; but few of our country subscribers have paid, and many in town are in arrears. Our number for December, will not be forwarded, until the amount due is paid. In future, payment must be made in advance, by those who live at a distance.

THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS, INTERNAL IMPROVEMENTS, AND GENERAL SCIENCE.

DECEMBER, 1826.

Report of the Committee of the Franklin Institute, on the Inclined Plane of Professor James Renwick.

[CONTINUED FROM PAGE 263.]

EXTRACT FROM THE REPORT OF GENERAL S. BERNARD, AND LIEUTENANT COLONEL JOSEPH G. TOTTEN, *(of the United States Engineer department)* ON THE MORRIS CANAL.

"The great expense of such a system of locks, in first cost, in water, and in time, would have been fatal to the project; but happily, the science and ingenuity of Mr. Renwick, aided by the success of analogous attempts in Europe, have found out an expedient by which this formidable elevation of the summit, may be overcome at a comparatively small expense. His idea is, the combination of locks and inclined planes, or rather the use of either, as local circumstances may dictate; the plan of Mr. Renwick, bold, ingenious, and novel, promises such improvement in the mode of passing from one level to another, and indeed such a facility in overcoming obstacles, which, in the existing mode, might be regarded as insuperable, that we consider it our duty, to enter with some minuteness, into its details.***

"As to the time which will be taken to pass the locks, we will assume the maximum given by experience, viz:—1st case. A descending boat, finding the lock full, 6 minutes; viz: 1½ to enter, 3 to fill, and 1½ to leave the lock.—2nd case. A descending boat, finding the lock empty, 9 minutes; viz: 3 to fill, 1½ to enter, 3 to empty, and 1½ to leave the lock.—3d case. An ascending boat, finding the lock empty, 6 minutes; viz: 1½ to enter, 3 to fill, and 1½ to leave the lock. 4th case. An ascending boat, finding the lock full, 9 minutes; viz: 3 to empty, 1½ to enter, 3 to fill, and 1½ to leave the lock. The mean of these four cases is 7½ minutes.

"We pass on now to an examination of the proposed canal, in the most favourable point of view, that is, as it appears under favour of the ingenious invention of Mr. Renwick.

"Fixed locks were, for a long time, the only means in use for getting over the elevations in the route of canals; but although they are certain, and safe, where there is a sufficiency of water, experience and reflection both show, that they are inapplicable where the quantity of water is small, and inadmissible where the elevations are so considerable as to extend the cost of construction, and the time of making the passage, beyond certain limits. Even in cases where they are advantageously applied, there is this inherent objection, that they require more water to pass a boat, than is sufficient to float the boat. * * *

"Several engineers of reputation have occupied themselves with researches, as to proper substitutes for locks, in cases where these only, can be applied advantageously. Messrs. Fulton, Leach, Reynolds, Ducart, Anderson, Rowland, Pickering, Weldon, and the Duke of Bridgewater, in England, and Solages, Bossut and Forey, in France, have severally proposed plans of this nature; and some of them have been carried into successful operation. Reynolds constructed, at Ketley, in Shropshire, an inclined plane, with two parallel iron railways: a loaded descending boat, by means of a rope passing round a wheel at the upper end of the plane, drew up a half loaded boat. On the Duke of Bridgewater's canal, is an inclined plane analogous to the above, in full operation.

"On the Ellismere canal, in Derbyshire, Rowland and Pickering, constructed a moveable lock, with a vertical lift and counterpoise. Mr. Weldon employed nearly similar means in the coal canal near Bath; and, lastly, a moveable lock, on similar principles with the last, was successfully applied by Forey, on the plans of Bossut and Solages, to the "Canal du Creusot," in France. The expedients proposed by these engineers, are of two kinds: *first*, inclined planes, with parallel rail-ways, on which the boats ascend and descend alternately, and *secondly*, vertical lifts, working in a similar manner. Either of these expedients is applied, and sometimes both, as local circumstances require.

"The invention of Mr. Renwick is of the first kind. It is an inclined plane, on which are fixed two parallel sets of iron rail-ways, (see plan, profiles, &c. herewith,) each set serving for a lock to ascend and descend. The lock is supported upon, and moves with, a carriage, the top of which is horizontal, the bottom being parallel with the inclined plane. Under the bottom of the carriage, and securely fastened to it, are a number of iron truck wheels in two rows, corresponding with, and revolving along, the rail-way belonging to the lock; two strong chains are secured to, and passed round a drum at the end of the upper level; the other parts being brought down and fastened, one on each side, to the lower part of the lock. As each of these chains is strong enough to sustain a loaded lock, all danger of accident, during the transit, is guarded against. The two locks used by Mr. Renwick, on his inclined plane, are precisely alike, in all respects; but as there are two cases likely to occur in the application of this invention, requiring different methods of giving motion to the locks, it is necessary to describe the method devised for each.

"1st. The case, when the triangular space between the end of the lower level, and the lower part of the inclined plane, can be kept dry, by draining. On this supposition, it will only be necessary to have a drum at the end of the upper level, extending across both rail-ways; to wind the chains of one lock around this drum, in a different direction from the chains of the other lock, and to have the chains of one lock wound up entirely, and the lock at the top of the plane, while the chains of the other are unwound, and the lock at the bottom. Such being the arrangement, it is obvious, that by permitting the escape of a little water from the lower lock, the upper will preponderate, and by descending and turning the drum, wind up the chains of, and, of course, draw up, the lower lock. This will, however, be an accelerating motion, unless water is permitted to escape gradually from the descending lock; because the lengthening chain in the one lock, and the shortening chain in the other, continually increase the preponderance of the descending lock.

"2nd. The case, when, from there being no lower ground near, the triangular space must be kept full of water. Here, the above simple arrangement will not answer, because the moment the descending lock enters the water of the triangular well, it loses its relative weight, and soon ceases to preponderate. To surmount this difficulty, Mr. Renwick has introduced the following very ingenious device. Instead of a drum common to both locks, there is one for each lock, and each drum is provided with two spur-wheels, of different diameters: the two small wheels of the two drums are, however, alike as to the diameter and number of teeth, as are the two larger wheels. The intention of this contrivance, is, that by gearing the large wheel on the drum of the lock about to descend, with the small wheel on the other, the descent of one lock to the edge of the water, will draw up the other the whole length of the plane; because a given number of revolutions of the larger will produce a greater number of revolutions in the smaller wheel, and of course, in the drum on which the chains are wound; but the descending lock, after effecting a complete transit of the ascending lock, has still a short descent to make before arriving at the end of the lower level. This is done by ungearing the drums entirely, and letting the lock descend by its own weight, taking care, however, to check this motion properly, in a way not unlike that of checking the chain cables of ships.*

"The passage of boats, from one level to another, is a very simple operation, in either of the cases stated above. A boat, arriving at either end of the inclined plane, passes at once into the moveable lock, which, being fastened to the end of the canal level, is, as it were, a prolongation of that level; the gates are then shut, and the transit takes place, whether there be a boat in the other lock or not.

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* Another method of obviating this difficulty resulting from the water contained in the lower level, is described by Betancourt; this plan is described in the present number of this Journal.

"Before comparing the expense of these moveable locks, with that of fixed locks, we will observe, that the correctness of the principles on which this invention depends, and the success of like contrivances in Europe, leave no reason to doubt of its perfect fitness to the object in view, and of its great utility.

"A just comparison of these, with ordinary locks, requires an examination of the cost of construction, the loss of water, and the consumption of time.

"From Mr. Renwick's estimate, it appears that a foot of the inclined plane, with its iron rail-ways, and the chains for the locks, costs $133 63.

The moveable locks, - - - - - - -	824 00
The masonry, wood work, and machinery at the top and bottom of the inclined planes, - - - - - -	2312 00
	$3136 00

"The first sum above stated, must, in each case, be multiplied into the number of feet lift required for the inclined plane; the second, being a constant quantity, is to be added to that product, for the whole expense. As one of these is a constant, and the other a variable quantity, the price per foot lift will be variable, diminishing continually with the increase of the number of feet in the lift: and, as the constant quantity is considerable, it will be found, that at short lifts, the advantage as to expense, will be in favour of fixed locks; but the inclined plane is inapplicable when the length does not exceed a certain quantity; and it will be found, by consulting the following table, that there will be considerable economy in its use, from the moment the fall is great enough to admit its application. It will also be seen, on reference to the table, that the price of fixed locks per foot rise (with a given lift to each lock) is constant, and that for 48 feet of rise, the whole expense is about twice, and for 120 feet, about twice and a half, as much as that of moveable locks. The table is calculated on the supposition that the inclined plane makes an angle of 14 deg. 28 min. 40 sec. with the horizon, or in other words, that the vertical rise being one, the length of the inclined plane is four.

TABLE

Showing the comparative expense (in dollars) of moveable and fixed locks, from 8 to 152 feet rise.

	Vertical heights of inclined plane.	Length of the inclined plane.	Price per foot lift of inclined plane with moveable locks.	Total price of the whole lift with moveable locks.	Price per foot lift of common locks.	Total price of the whole lift with common locks.	Difference in that cost between fixed and moveable locks.
1	8	80	$525 50	$4,205 04	$400	$3,200	$1,005 04
2	10	96	447 23	4,472 30		4,000	472 30
3	12	112	394 96	4,739 56		4,800	60 44
4	16	128	329 63	5,274 08		6,400	1,125 92
5	20	144	290 43	5,808 60		8,000	2,191 40
6	24	160	264 30	6,443 12		9,600	3,256 88
7	28	176	245 63	6,877 64		11,200	4,322 36
8	32	192	231 63	7,412 16		12,800	5,387 84
9	36	208	220 74	7,946 68		14,400	6,453 32
10	40	224	212 03	8,481 20		16,600	7,518 80
11	44	240	204 90	9,015 72		17,600	8,584 28
12	48	256	198 96	9,550 24		19,200	9,649 76
13	52	272	193 93	10,084 76		20,800	10,715 24
14	56	288	189 63	10,619 28		22,400	11,780 72
15	60	304	185 89	11,153 80		24,000	12,846 20
16	64	320	182 63	11,688 32		25,600	13,911 68
17	68	336	179 75	12,222 85		27,200	14,977 16
18	72	352	177 04	12,757 36		28,800	16,042 64
19	76	368	174 89	13,291 88		30,400	17,108 12
20	80	384	172 83	13,826 40		32,000	18,173 60
21	84	400	170 96	14,360 92		33,600	19,239 08
22	88	416	169 25	14,895 44		35,200	20,304 56
23	92	432	167 71	15,429 96		36,800	21,370 04
24	96	448	166 29	15,964 48		38,400	22,435 52
25	100	464	164 99	16,499 00		40,000	23,501 00
26	104	480	163 78	17,033 52		41,600	24,566 48
27	108	496	162 66	17,568 04		43,200	25,631 96
28	112	512	161 63	18,102 56		44,800	26,697 44
29	116	528	160 66	18,637 08		46,400	27,762 92
30	120	544	159 76	19,171 60		48,000	28,828 40
31	124	560	158 92	19,706 12		49,600	29,993 88
32	128	576	158 12	20,200 64		51,200	30,959 36
33	132	592	157 40	20,775 16		52,800	31,024 84
34	136	608	156 68	21,309 68		54,400	32,090 32
35	140	624	156 03	21,844 20		56,000	34,155 80
36	144	640	155 40	22,378 72		57,600	35,221 28
37	148	656	154 82	22,913 24		59,200	36,286 76
38	152	672	154 26	23,447 76		60,800	37,352 24

It will be observed that the first quantities in the last column of the table, are in favour of the common fixed lock, all the others being in favour of the inclined plane. Only $400 is assumed as the cost of locks per foot rise, on the Morris Canal; the usual price is about $800 on the majority of canals of small section in the United States.—[*Note of the Committee.*

"What has been said, is sufficient to show the great advantage as to economy, which these moveable locks have over the common fixed locks; but, in relation to comparative expense, it only remains to add, that this advantage will increase with the sines of the angles of elevation of the inclined planes, up to that degree of elevation which experience will show it will be hazardous to exceed.

"The quantity of water used by these moveable locks, is the least possible, since they contain no more than is sufficient to float the boat, which, as has been said, is far from being the case with fixed locks. It is true, that if a moveable lock, having descended without a boat, receives a boat at the lower level, to carry up, it will lose part of the water brought down: but this is compensated when the case is the reverse; that is, when the lock, having brought down a boat, is to ascend without one; for then the lock receives water from the lower, to carry back to the upper level. The absolute loss for each transit, being always only that which is permitted to escape from the lock at the bottom, that the lock at the top, may preponderate sufficiently to overcome the friction of the truck wheels.

"As the moveable locks contain no more water than is necessary to float the boat, no time is lost, as is the case in fixed locks, in emptying and filling them. On the entrance of a boat, the water which is displaced, passes into the canal, and on its exit, water rushes into the lock, to fill the space it occupied, the trifling deficiency of water in the ascending boat, making no sensible difference. The time employed by a boat, therefore, in making a transit from one level to another, is consumed, first, in entering a lock, second, in moving along the inclined plane, and third, in passing out of a lock. Supposing the lifts to be sixty-four feet, and the inclination of the plane 14 deg. 28 min. 40 sec. the length to be moved over by the boat, will be 250 feet. This might be passed very rapidly; but with a view to save the machinery, and to guard against accidents, and also to allow for the time required to adjust the locks to the end of the canal, and to regulate the preponderance of the upper boat, we take twenty feet, per minute, as the velocity of the locks. In these suppositions, the time consumed will be as follows:

	min.
To enter the lock	1½
To move over the inclined plane	12½
To leave the lock	1½
Total, 15½ minutes to rise 64 feet,	15½

"To the same height of 64 feet, with 8 common locks, at 7½ minutes each, the time would be 60 minutes, or four times that required by moveable locks.

"We might show, in addition to the above striking general advantages, the great superiority of the moveable lock, in case of a great and sudden descent, where common locks must necessarily be contiguous, or near to each other; but we consider all further comparisons, of this sort, superfluous.

"It has been before stated, that the whole ascent and descent of the Morris canal is 1644 feet, and that to pass the 206 fixed locks, which that number of feet requires, would take 25 hours and 46 minutes, which added to the 19 hours required to pass along the levels, gives a total of 44 hours and 45 minutes, or at 12 hours a day, 3⅔ days. But by combining the system of fixed locks, with inclined planes, as Mr. Renwick proposes, the whole passage will be made in 28 hours and 33½ minutes, or in 2⅓ days, as will be seen below. Along the route of the canal, there are several small depressions of level, in which fixed locks alone can be used: and the whole amount of these is 244 feet, leaving 1400 feet for the inclined planes. Giving 8 feet lift to the locks, and 64 feet to the planes, the time occupied in the passage will be as follows:

	h. min.
For 244 feet lift with locks, requiring 31 locks at 7½ minutes each, - - - - - -	3 52½
For 1400 feet lift, with planes requiring 22 planes, at 15½ minutes each, - - - - -	5 41
For passing along the levels, as before stated,	19 00
Total time in hours and minutes,	28 33½

The gain will, therefore, be 1⅓ days in each passage.

"We will now see what this will amount to, as regards economy of transportation, both with respect to the boats, and to the men employed with them.

"Supposing 291,000 tons are to be transported from the Delaware to the Passaic, in eight months, or 240 days, there will be 1212,5 tons per day, which, at 25 tons a boat, will require 48 boats to leave the Delaware, daily. With a system of locks, 3⅔ days will be consumed in reaching the Passaic; 1 day in unloading, 3⅔ days in returning, and 1 day in taking in a new cargo, making 9⅓ days. It will be necessary, therefore, if 48 boats are to leave the Delaware every day, to employ nine times 48 boats, or, in the whole, 432 boats. But, with the system of inclined planes, combined with locks, 2⅓ days will be consumed in the passage; 1 day in unloading, 2⅓ days in returning, and 1 day in taking in a new cargo, making only 6⅔ days: on the 7th day, the boats might begin the second voyage; but we will suppose that they do not until the eighth, which will require seven times 48 boats, or, in the whole, 336 boats. Now, as 336 is about the ⅘ of 432, it follows, that there will result a saving of about 20 per cent. on the charter of the boats. A like economy will result in regard to the men employed with the boat; for in one case, 864 men must be employed during 8 months, and in the other, only 672, to transport the 291,000 tons, giving a saving of about 20 per cent. in the number of the men. The consequence will be the same also, as regards animal labour; and it is scarcely necessary to remark, that all these savings must diminish the price of freight in the same proportion.

"We here terminate our report on the projected Morris canal; having gone into the extended and minute examination which we thought due to a project so important in its general and local relations. This examination, shows that the project, under any point of view, is practicable as to cost, and promising as to revenue; but that, in both these respects, there is a decided preference to be given to a system of inclined planes, combined with fixed locks, as proposed by Mr. Renwick. It is to be greatly desired therefore, that the invention of this gentleman, may be sanctioned by experience; because, not only will the execution of the design, as it slowly progresses, enable him to mature and perfect its details, but it is experience, alone, which can effectually remove the fears and doubts with which inventions, the most useful, are, at first regarded. To us, however, whether we consider the economy, the utility, or the durability of these inclined planes, ALL IS CERTAIN; and we look confidently forward to the day when their introduction will be regarded as a most important era in the history of canal navigation, and especially in this country, to which they are so peculiarly adapted."

Signed by S. BERNARD, Brig. Gen.
JOSEPH G. TOTTEN, Maj. Eng.
Brev. Lieut. Col.

Your committee having now submitted these strong and conclusive testimonials in favour of the plan of Mr. Renwick, beg leave to offer their opinions, which entirely accord with those of the engineers, herewith submitted, in relation to the utility of the plan.—Your committee respectfully offer a few suggestions, respecting some improvements, which they are induced to believe may still further increase the utility of the project.

1st. To ensure a more equal bearing of the wheels of the lock carriages, on the rail-way of the inclined plane. If this plane were *mathematically accurate*, and the wheels *perfectly cylindrical*, and, if they were inserted into a beam *perfectly straight*—and, if all these arrangements could be rendered *permanent*—each wheel, of the 8 proposed in the plan, would, at *all times*, support an *equal* proportion of the superincumbent weight; but this is obviously impossible. and, in consequence thereof, certain parts of the apparatus will be liable to an *unequal* and *variable pressure*, sometimes of great intensity, and increasing in proportion to the wearing of the materials. The committee are of opinion, that this defect may be partially obviated by a contrivance similar to that which may be observed in the arrangement of the wheels of some of the locomotive steam engines in Great Britain;—viz. the wheels may be attached, in pairs, to a connecting beam, which will support the carriage by a pivot attached to its centre, on which it will traverse; one of these beams must be attached to each corner of the car, or moveable lock, and a wheel be inserted therein, at each extremity; the weight reposing on each corner of the car, will then be equally sustained by each pair of wheels. If a heavier lock carriage be required, for the purposes of navigation, these wheels may be indefinitely multiplied on this principle, without any necessity of resorting to a rail-way of increased strength.

2d. To ensure the contact of the upper moveable locks, by some other means than the mere preponderance of the descending cars. If this be not effected, a waste of water will occur. A powerful screw, or lever, may be attached to the termination of the upper levels, and worked by the attendant, which will accomplish this object.

3d. The section of the present locks, exhibits *rectangular* parallelograms. As the section of a boat seldom exhibits, and never ought to exhibit, this figure, the sides of the lock ought not to be vertical, but should be adapted to the curvature of the sides of the boats employed. As less water will be contained in the locks, if this plan is adopted—less friction will be the result; consequently, less power will be expended, to overcome the resistance. The resistance may be still further reduced, by increasing the diameter of the wheels, sustaining the locks on the inclined plane.

4th. To prevent accidents, from the accelerated velocity of the locks on the inclined plane, which might result from the negligence of the superintendents of the apparatus, in neglecting to apply the stoppers to the chain cables.

If a centrifugal, or an hydraulic brake, were attached to the apparatus, all danger from the above cause, would be completely obviated, and the locks could safely proceed on the plane with greater velocity, than a proper regard for their safety would justify, on the present plan.

These alterations would, in the opinion of the committee, increase the utility of this valuable apparatus.

We now conclude this examination of the ingenious project, which has been submitted to our attention, by congratulating our fellow citizens on the appearance of a plan, by which the mountains and hills of our country, which, at present, prevent a free, uninterrupted, and economical exchange of the productions of agriculture, commerce, and manufactures, may soon cease to be *insurmountable* obstacles to this beneficial intercourse;—a plan, the importance of which, will become every day the more apparent, until the present system of canal navigation be superseded by other means, which the progress of science may hereafter establish. The committee, therefore, recommend, that a medal be presented to James Renwick, for his improvements effected in the apparatus for working the Inclined Plane.

Signed,

JOHN WILSON, Civ. Engr.
HARTMAN BACHE, Top. Engr.
GEORGE W. SMITH,
GERARD RALSTON,

Committee on the Inclined Plane, of Professor James Renwick.

Letter from Professor James Renwick to G. W. Smith, Esq. one of the Committee of the Franklin Institute, to which the examination of the model of the Inclined Plane, &c. was referred.

Columbia College, New York, October, 1826.

SIR—I reply with pleasure to your question: "How far the plan of an inclined plane, sent by me to the exhibition of the Franklin Institute, is original?" I do this with the more alacrity, as I do not conceive, that in the present state of science, reputation, as an engineer, is to be derived from a search after novelties, but, rather from an adaptation, successfully, to useful purposes, of known machinery, and received philosophical principles. Were, indeed, my plan, in every respect, a copy, I should not hesitate to avow it, as I should feel it a sufficient honour to bring, to the notice of the public, a valuable, but forgotten invention. It is, indeed, no unimportant part of the duties of my Professorship, to keep alive, or restore, the inventions of earlier date. But, this is not the case with the inclined plane, whose model has been submitted. I have not, after the most diligent enquiry, hesitated to take the oath prescribed by the patent law, and I procured the signatures, as witnesses, to my specification, of the late and present heads of the United States Board of Engineers, after they had, also, examined the question of originality: a question, of which their greater opportunities for research, made them more competent judges, than myself.

The model exhibited, is the result of the investigations I undertook at the desire of the New Jersey Commissioners, who, in examining the route of the Morris Canal, became aware, at an early period, that it could not be executed, within any reasonable limit of cost, by the ordinary method, and would not, if so executed, be of any great value, either to the state, or its stockholders, in consequence of the great length of time that would be consumed in passing through from 160 to 200 locks. The exact course of my studies, on the subject, is detailed in my report to those commissioners, and, as that is in your hands, I need not here repeat what I have there stated.

The principle of two counterpoising locks, filled with water, and each carrying a boat, to which system, motion is given, by letting water from a lower lock, is first stated by Dr. Anderson, in his plan for a perpendicular lift; but, in spite of numerous attempts to bring it into use, it has never been applied successfully. I was not, at the time, aware, that to apply this principle to the inclined plane, had ever occurred to any person whatever. The project of Leach, referred to, in the report of the United States Engineers, on my inclined plane, although it comprises the principle of counterpoising weights, one of which might be wholly, or partly water, yet adopts an extrinsic force, as the prime mover. I do not remember, that I derived any advantage from the perusal of it, although I have subsequently found, that it was assumed by De Solages, in France, as the basis of an investigation, which departed from the same point whence I set out, but which led, as I shall hereafter explain, to a widely different result.

The necessity of suspending each car, or lock, by at least two chains, occurred to me in consequence of an accident that had nearly been attended with fatal consequences, at Rochester, in this state, upon an inclined rail-way. In seeking the best means of gearing two chains, I fell upon the horizontal shaft, and thence passed, for the sake of convenience, to two horizontal shafts, turning each other, in opposite directions, by means of spur-wheels.

At this stage of the investigation, an examination of one of the proposed sites, near Stanhope, in New Jersey, showed me, that cases would occur, where the descending lock must enter the water of the lower level; a variation in the size of the spur-wheels, suggested itself, at once, as a remedy, and, of course, the necessity of having one, of each size, upon each of the shafts, with a lever to throw them, alternately, in, and out, of gear. I soon afterwards discovered, that the same difficulty had occurred to Betancourt, who had contrived a mode of overcoming it. This mode is much more complex than mine, which grew, naturally, out of the position and action of the shafts.

In relation to the manner of supporting the locks constantly in a horizontal position, I was aware, that wheels of different diameters, had been actually used, (at Hadley;) but I saw many objections to their employment, so that, from the very first, the idea of a triangular frame, beneath the lock, supported upon wheels of equal diameters, occurred to me. In constructing the model, I derived the hint of the mode of fitting the wheels, (a matter of no great importance,) from a draught of Morton's marine rail-way, which I had before me, when consulted by the original projectors of the Dry Dock Association.

You may have remarked, that in the model, the joint between the locks and the gates of the canal, is rendered tight, by leather; this, I do not think, would answer well on the full scale; but, I have a mode of effecting that object, which, I am satisfied, will succeed fully; but which however, I do not wish to publish at present, any more than several other little matters that frequent reflection on the subject, and experiments on the model, have suggested; and which, if not essential, will, at least, contribute to the success of the operation.

The reservoir beneath the locks, is no part of the plan, at least as necessary to the full size. The model, originally, worked well without it, although containing but two-thirds of the water, in proportion to its size, that the large one would. But, the reservoir was added, in consequence of the risk of rust, and injury to the parts, that were anticipated, when the model was sent to Trenton, for exhibition to the Legislature of New Jersey.

After the United States Board of Engineers had nearly completed their report, General Bernard was informed by Count Real, that he had in his possession, at his house on the St. Lawrence, a plan, founded upon principles similar to mine. The plan was sent for, and anxiously expected. On examination, it appeared to be the work of De Solages, who, as already stated, acting upon the hint furnished by Leach's project, had set out from the same point with me, but had found insuperable difficulties, in adapting two moveable locks to his inclined plane, and had, finally, been compelled to limit himself to one lock, counterpoising it by two reservoirs, moving upon two lateral rail-ways. So far, therefore, from having cause to look upon my plan, as an unintentional repetition of that of De Solages, I had the additional pleasure to find, that I had vanquished difficulties, which had appeared insuperable, to one of the first engineers of Europe. As Bramah, in England, and Dearborn, in this country, had, in like manner, failed in applying Dr. Anderson's principle to the perpendicular lift, and had been compelled to have recourse to solid lateral counterpoises, to a single, instead of two locks, I conceived myself, from that moment. justified in believing, that I was the first who had pointed out a practical mode of applying that beautiful and simple principle.

A short time since, I was informed, that an impression existed, that many of the points, on which I relied for the originality of my views, were to be found in the specification of a patent, taken out in England, by Fussell, in 1798, and published in the Repertory of Arts, for that year. As you may well suppose, I felt mortified at this intelligence, particularly as that work was within my reach, and had been consulted, occasionally, when the subject was first proposed to me. I had, however, soon ceased to make use of it, as I found a synopsis of every important paper, relating to this question, in the article Canal, in Rees' Cyclopedia. On reference to Rees, which I had at hand, I discovered nothing to justify the impression that had been conveyed to me, as Fussell is merely quoted as the inventor of an abortive perpendicular lift. On consulting the original paper, however, in the Repertory, I found, what had before escaped me, namely, that he states, that in case the descent should be in *hard rock*, an inclined plane, with rail-ways, may be substituted for his vertical pit. I had not, before this time, perused the whole of Fussell's paper, probably, in consequence of my considering it, from its title, and the synopsis in the Cyclopedia, as referring to the lift alone; but, had I done so, it might have furnished me with a hint of the principle on which I proceeded, had I not previously obtained it from Dr. Anderson's paper, in the first volume of the same work. But in the manner of its application, connecting the cars, by a single chain passing over an inclined wheel, Fussell differs, *toto cœlo*, from me. His words are, evidently, those of a person, pointing out a probable extension of his invention, without any precise idea of the manner in which it was to be, practically, effected; and, I do not see, with a gate, falling into a case *beneath* the car, how his locks could be set on an inclined plane, or their connexion effected practically; while the additional risk, created by the axle of the inclined wheel, which would, necessarily, be weak, and, the fact of his trusting to but one chain, would render it insecure, and dangerous, in the highest degree.

I have thus, sir, given you such a statement, as will enable you to judge how far I am entitled to any merit, in the plan of the inclined plane I have sent for exhibition; and I think you will from it be satisfied, that, while I must, as at present advised, concede to Fussell the claim of having first pointed out, that Dr. Anderson's principle was applicable to the inclined plane, as well as to the perpendicular lift, I am still entitled to the right of priority in every part of the model, that is essential to its success in practice, and to its safe and ready use; and moreover that where I trod in the same path with other persons, it was without a knowledge of their previous discoveries.

I am, Sir, your obedient servant,

James Renwick.

ANCIENT VASES.

(Continued from page 226.)

Although the black coating produced in this manner upon the surface of earthen vessels, agrees in many of its qualities with the varnish of the antique Grecian vases, and it is not improbable, that a similar substance, and a similar mode of painting, was used in their manufacture, yet the varnish prepared in the manner above described, differs from the ancient varnish in this respect, that it does not resist a very great degree of heat; nor have I as yet succeeded in my efforts to discover, by what means the faculty of sustaining the power of an intense heat, could be given to varnish prepared of *asphaltum*. However, it is evidently not impossible, that time may have done something in this respect, which art could not produce.

It is well known, that *asphaltum* and *naphtha* were among the substances known to the ancients, and that they were applied by them to various purposes. Pliny, in fact, relates, that inscriptions made with *Jet* (Gagates) upon earthen-ware, are not effaced. But, from what we learn with regard to this *Gagates* of Pliny, it is to be inferred, that it was not the *Jet* of modern times, but *asphaltum;* which renders it probable, that the art of making a coating for earthen-vessels of that substance, was known to the ancients. The varnish and paintings, indeed, which occur in the sepulchral vases of the Greeks, do not seem to have been applied by the Romans to earthen-ware manufactures; for no traces of them occur among the numerous remains of Roman pottery. A covering, however, in some respects similar to it, but consisting of vegetable pitch, was used by the Romans in their wine vessels, the preparation of which is accurately described by *Columella*. I do not doubt that a varnish made from *asphaltum*, in the manner above described, and the mode of painting founded upon it, to which the name of Enamelling is applied, might be used with advantage in modern pottery; as for ornamenting vessels, covering tiles, &c.

Besides the black varnish, some other colours are seen in Grecian and Etruscan sepulchral vases; for example, white, yellowish white, red, brown, rarely bluish-green or livid. In the vases whose paintings are made of the varnish itself, particular parts only of the paintings consist of these colours; for example, leaves, flowers, architectural ornaments, the drapery of figures, the wings of winged figures, horses, chariots, &c. In other vases, which are evidently covered with black varnish, certain ornaments are sometimes laid in upon it with other colours, especially white. The nature of these pigments is as follows: 1. They are, without exception, opaque, and belong to the paints, called in German, *Deckfarben*. 2. They seem prepared either from earth or metallic oxides; for example, the white pigments from argil; the red, from oxide of iron; the brown, from oxide of iron mixed with oxide of manganese. 3. They are not vitreous, but have an earthy aspect. 4. They are not intimately united with the baked clay; they fall off, and may easily be abraded; they are partly dissolved in acids. 5. They are usually laid upon the black varnish, which appears evident enough when particles of the paint have fallen off, or are abraded, by which the black varnish is discovered. From these properties, it may be inferred, that antique painted vases have not been baked in the same manner as our earthen-ware is, along with the pigments, but have had the pigments applied to them after being baked.

We shall now, in the *second* place, speak of the *mechanical method* in which the varnish and paintings have been applied. All that I have observed with regard to this matter, during a diligent examination of Grecian and Etruscan vases, as well as all that has already been observed by others, agrees well with the opinion expressed above, regarding the composition of the varnish.

Some antiquarians have thought that the paintings of the Grecian vases have been perfected by the assistance of the moulds to which our workmen gave the name of *Patrones*. Others have supposed, not that the whole paintings, but the ornaments, have been made in this way. I cannot, however, give my assent to these opinions. If the figures or ornaments had been perfected by the aid of moulds, vases would undoubtedly be sometimes found in the same place, with the same paintings. But although similar representations are not unfrequently seen in different vases, there have never, in so far at least as I know, been found two vases, whose paintings correspond in every respect, which has already been remarked by *Grivaud*. If the ornaments, which might have been made by means of moulds, more easily than the more diversified and complex figures, be attentively examined, certain irregularities and slight blemishes will often be found, which would undoubtedly have been avoided, if moulds had been applied in the painting of vases.

From certain marks to be observed in the paintings, and varnish of vases, it may be inferred, that the black paint has not always been applied once only, but sometimes repeatedly. The first coating is not always accurately covered by the succeeding one; nor is it rare to find different shades of colour in the same vase. The parts of vases not covered by the black varnish, very frequently are of a red colour, which is darker than the peculiar colour of baked clay, and has also a certain degree of lustre; properties which have probably been produced by a single application of a thin varnish.

In vases whose figures are of a black colour, the outlines have first been drawn with a pencil, and the minor parts of the figures then filled up with paint; a mode of painting which is plainly discernible, for example, in some Locrian vases. In vases which have red figures upon a black ground, a similar mode of painting is often observable. In them, the outlines of the figures are covered with diluted paint, and the filling up of the black ground, is then perfected. In some vases, the ground-colour does not completely touch these outlines; in some others, the ground-colour passes over the outlines here and there; sometimes connexions of the outlines are observed; defects which clearly show the mode of painting. It may also be recognized by the circumstance, that the black colour is less intense in the places where the outlines have afterwards been covered by it, than in the other parts. According to the observation of *Meyer*, a first shading of the paintings with a red pigment, is rarely seen. In some vases, it is obvious that the outlines of the figures have been cut out with some sharp instrument. Instead of cut lines, dotted ones sometimes occur. *Jorio* has observed, that, in some vases, it is evident that the figures have been first painted naked, and afterwards covered with the drapery;—a mode of painting which was much in use even in the time of *Raphael.*

In vases with red figures upon a black ground, the internal delineation of some parts of the figures being of a deep colour, have undoubtedly been made, last. After the laying on of the black paint has been executed, other colours have sometimes been added to the paintings, as has already been noticed above. All the paintings of the ancient Grecian vases, have been done with a very fine pencil. If the black varnish has, in reality, been made in the manner above described, the greatest quickness has been requisite in applying it, according to the experiments described by me; and, therefore, the nicest address in the workman. A blunder committed, if it could not be covered over, was irreparable. Although a wonderful steadiness and sureness of hand is manifest in the paintings of vases, yet blemishes produced by haste, are not unfrequently seen.

We are, in the *third* place, to treat more especially of the operations required, after the application of the paints, for finishing the paintings.

We have shown above, that it is probable vases have not, after being first covered with a coating of varnish and other pigments, been again baked, like our modern glazed earthen-ware. Consequently, no further operations were necessary for finishing them. In some vases, however, engraved delineations occur, which penetrate through the black varnish, and present the clay colour of the base; in others, similar lines are seen, which pass through the pigments laid upon the black varnish, and lay the latter bare. These ornaments, which are of rare occurrence, could only have been produced, after the pigments had been applied, by means of a sharp stile.

In some vases there occur letters, either painted or cut out with a sharp instrument, which either exhibit the name of the painter, or notify the object of the painting.

The painted letters have been done in various ways. 1. In the most ancient vases they are black, upon a red ground. 2. In more recent ones, the ground on which they are laid, is sometimes white or red; or, 3. In the same manner as the figures, they are circumscribed by a black ground, and have the colour of burnt clay. The engraved letters upon some of the more ancient vases, are found either in the red ground, or in the black varnish.

ON ENGRAVING.

(From the Mechanics' Gallery. By C. F. Partington.)

(Continued from page 312.)

On Aqua tinta.

Having given a general idea of this art, we shall mention some particulars necessary to be attended to, in order to ensure success in the operation. The spirits of wine used for the solution, must be highly rectified, and of the best quality. What is sold in the shops generally contains camphor, which would entirely spoil the grain. Resin, Burgundy-pitch, and Gum-mastich, when dissolved in spirits of wine, produce grains of a different appearance and figure, and are sometimes used separately, and sometimes mixed in different proportions, according to the taste of the artist, some using one substance, and some another. In order to produce a coarser or finer grain, it is necessary to use a greater or smaller quantity of resin; and to ascertain the proper proportions, several spare pieces of copper must be provided, on which the liquid may be poured, and the grain examined, before it is applied to the plate to be engraved. After the solution is made, it must stand still, and undisturbed, for a day or two, till all the impurities of the resin have settled to the bottom, and the fluid is quite pellucid. No other method of freeing it from those impurities, has been found to answer; straining it through linen or muslin only fills it with hairs, which are ruinous to the grain. The room in which the liquid is poured on the plate, must be perfectly still and free from dust, which, whenever it falls on the plate, while wet, causes a white spot, which it is impossible to remove without laying the grain afresh. The plate must also be previously cleaned, with the greatest possible care, with a rag and whiting, as the smallest stain or particle of grease produces a streak or blemish in the grain. All these attentions are absolutely necessary to produce a tolerably regular grain; and, after every thing that can be done by the most experienced artists, still there is much uncertainty in the process. They are sometimes obliged to lay on the grains several times before they produce one sufficiently regular. The same proportions of materials do not always produce the same effect, as it depends in some degree on their qualities; and it is even materially altered by the weather. These difficulties are not to be surmounted but by a great deal of experience; and those who are daily in the habit of practising the art, are frequently liable to the most unaccountable accidents. Indeed it is much to be lamented, that so elegant and useful a process, should be so extremely delicate and uncertain.

It being necessary to hold the plate in a slanting direction, in order to drain off the superfluous fluid, there will naturally be a greater body of the liquid at the bottom than at the top of the plate. On this account, a grain laid in this way is always coarser at the side of the plate that was held lowermost. The most usual way is, to keep the coarsest side for the fore-ground, that being generally the part which has the deepest shadows. In large landscapes, sometimes various parts are laid with different grains, according to the nature of the subject.

The finer the grain is, the more nearly does the impression resemble Indian ink, and the fitter it is for imitating drawings: but very fine grains have several disadvantages; for they are apt to come off before the aqua fortis has lain on long enough to produce the desired depth; and as the plate is not corroded so deep, it sooner wears out in printing; whereas coarser grains are firmer, the acid goes deeper, and the plate will throw off a great many more impressions. The reason of all this is evident, when it is considered, that in the fine grains the particles are small and near each other, and consequently the aqua fortis, which acts laterally as well as downwards, soon undermines the particles, and causes them to come off. If left too long on the plate, the acid would eat away the grain entirely.

On these accounts, therefore, the moderately coarse grains are more sought after, and answer better the purpose of the printer, than the fine grains which were formerly in use.

Although there are considerable difficulties in laying, properly, the aqua tint grain, yet the corroding the copper, or biting-in, so as to produce exactly the tint required, is still more precarious and uncertain. All engravers allow that no positive rules can be laid down, by which the success of this process can be secured; nothing but a great deal of experience and attentive observation can enable the artist to do it with any degree of certainty.

There are some hints, however, which may be of considerable importance to the person who wishes to attain the practice of this art. It is evident, that the longer the acid remains on the copper, the deeper it bites, and consequently the darker will be the shade in the impression. It may be of some use, therefore, to have several bits of copper laid with aqua tint grounds, of the same kind to be used in the plate, and to let the aqua fortis remain for different lengths of time on each; and then to examine the tints produced in one, two, three, four minutes, or longer. Observations of this kind frequently repeated, and with different degrees of strength of the acid, will at length assist the judgment in guessing at the tint which is produced in the plate. A magnifier is also useful to examine the grain, and to observe the depth to which it is bit. It must be observed, that no proof of the plate can be obtained till the whole process is finished. If any part appears to have been bit too dark, it must be burnished down with a steel burnisher; but this requires great delicacy and good management not to make the shade streaky; and as the beauty and durability of the grain are always somewhat injured by it, it should be avoided as much as possible.

Those parts which are not dark enough, must have a fresh grain laid over them, and be stopped round with varnish, and subjected again to the aqua fortis. This is called re-biting, and requires peculiar care and attention. The plate must be very well cleaned out with turpentine before the grain is laid on, which should be pretty coarse, otherwise it will not lay upon the heights only, as is necessary, in order to produce the same grain. If the new grain is different from the former, it will not be so clear nor so firm, but rotten.

We have now given a general account of the process of engraving in aqua tint, and we believe that no material circumstance has been omitted, that can be communicated, without seeing the operation: but after all, it must be confessed, that no printed directions whatever can enable a person to practise it perfectly. Its success depends upon so many niceties, and attention to circumstances apparently trifling, that the person who attempts it must not be surprised if he does not succeed at first. It is a species of engraving, simple and expeditious, if every thing goes on well; but it is very precarious, and the errors which are made are rectified with great difficulty.

It seems to be adapted chiefly for imitation of sketches, washed drawings, and slight subjects; but does not appear to be at all calculated to produce prints from finished pictures, as it is not susceptible of that accuracy in the balance of tints necessary for this purpose. Nor does it appear to be suitable for book-plates, as it does not print a sufficient number of impressions. It is, therefore, not to be put in competition with some other modes of engraving. If confined to those subjects for which it is calculated, it must be allowed to be extremely useful, as it is expeditious, and may be attained with much less trouble than any other mode of engraving.

FROM THE GLASGOW MECHANICS' MAGAZIN

ESSAYS ON BLEACHING.

By **James Rennie**, A. M. Lecturer on Philosophy, &c. &c. London.

No. I.

Continuation of the History of the Art.

We have mentioned the improvement which Mr. Henry made in the application of chlorine, by the intervention of a calcarious mixture applied to the cloth. This, it must be confessed, was a considerable advance towards perfection; but was found to be both inconvenient and dangerous to the workmen, from the disengaged state in which the gas remained in the vessel, before combining with the lime; while the chance of the goods being unequally exposed, rendered it somewhat uncertain. It was reserved for Mr. Tennant, of Glasgow, to remove these difficulties, by the discovery of a method of combining chlorine with lime in a separate vessel, which contained lime suspended in water by mechanical agitation. The redundant lime was allowed to subside, and a clear liquid, which was a solution of the oxymuriate of lime, was applied properly diluted to the purpose of bleaching. "It is worthy of remark," Dr. Brewster observes, "that this combination, even when the chlorine is perfectly neutralized, has the power of bleaching light or thin goods, though it is much less active in discharging some vegetable colours." Hence this method has certainly a great advantage over all former ones, in the facility and safety of its application, especially to coloured goods, which would have their colours discharged by the contact of either the acid or the quicklime, in an uncombined form. This discovery was secured to Mr. Tennant by a patent, dated January 30th, 1798, which has since been set aside by a legal decision.

Nearly about the same time, the French chemists, and practical bleachers, made considerable improvements on the mode of Berthollet, chiefly in the apparatus, and in the use of a combination of potash with chlorine. These are detailed in a work by Des Charmes, which, as a practical treatise, is above all praise, and to which I hold myself greatly indebted for important information. Sometime previous to this also, the trustees for the linen and hempen manufactures in Ireland, published a report of experiments to ascertain the merits of the several bleaching liquids prepared from chlorine, which contains some useful knowledge, and rationales, not before published. This was followed, in the same quarter, by Kirwan's accurate experiments upon the different alkalies used in bleaching, who first showed the bleacher how to ascertain the qualities of those important agents. Mr. Higgens of Dublin, also, whose chemical abilities are well known, discovered a new agent, namely, sulphuret of lime, which he recommended in a small work on the theory and practice of bleaching, published in 1799. This has never come into general use, so far as I can learn. There seems, indeed, to be some peculiar nicety in the management, which renders its application, in the hands of the inexperienced, liable to uncertainty. From this circumstance, some of the bleachers of Glasgow who attempted to introduce it, had their goods corroded and destroyed.

At a still later period, say 1800, Chaptal made several experiments on the application of alkaline vapours to bleaching and washing. These were published in the several Scientific Journals of Europe, and detailed at some length by D'Orelly, in his *Essai sur le Blanchament.*

Mr. Tennant, however, still retains a patent for manufacturing the dry oxymuriate of lime, the discovery of which is among the latest and most interesting improvements in chemical bleaching, as it acts with greater safety and effect, while it is not so liable as the other preparations of chlorine, to give out the deleterious gas, which, in the old mode, was so apt to injure the workmen. It can also be carried to a distance with greater ease than any of the liquid combinations, and Mr. Tennant accordingly supplies the bleachers of Ireland and England with oxymuriate of lime, as well as those in the immediate vicinity of his manufactory.

The oxymuriate of magnesia has very recently been recommended by Sir Humphrey Davy, and Mr. Ramsay, of Glasgow, for clearing the whites of printed calicoes, and promises to be an improvement of considerable importance.

In the apparatus of bleaching, there have lately been radical and important alterations made, some of which are of great utility. The whale boiler may be mentioned as an example of these. It is an ingenious substitute for the old bucking apparatus, and is well deserving of attention. It has been but lately introduced in the bleaching works around Glasgow: its utility, however, I am persuaded, will soon bring it into general use. In proportion, indeed, as the apparatus of chemistry, considered generally, is improved, so will the apparatus in bleaching.

But it is not unlikely that this art may soon be altogether superseded, at least in so far as regards the bleaching of linen goods; if the mode of manufacturing flax, invented by Mr. Lee, ever come to be generally adopted, or, if it be true, that when flax is so manufactured, the linen produced from it can be made sufficiently clear and white by simple washing. It was about two years ago that Mr. Lee took out a patent for obtaining hemp and flax directly from the plants, by a new method. He neither steeps his flax nor spreads it on the grass. When the plant is ripe, and it must be allowed to ripen more perfectly than when the common method is followed, it is pulled in the usual way. It is then thrashed by placing it between two grooved wooden beams armed with iron. One of these is fixed, the other is suspended upon hinges, and is made to impinge with some force on the fixed beam; the grooves in the one beam corresponding with flutes in the other. By a mechanical contrivance, almost exactly similar, the woody matter is beaten off, and the fibres of flax left. By passing these through hackles, varying progressively in fineness, the flax is very speedily dressed and rendered proper for the use for which it was intended. The advantages of this process are manifold. The expense of steeping and spreading is saved; a much greater produce of flax is obtained; it is much stronger; the fibres may be divided into much finer fibrillæ, so as to obtain at once, and in any quantity, flax, fine enough for the manufacture of lace. But the greatest advantage is the ease with which it may be bleached. For the colouring matter not being chemically combined with the fibre, as is the case with what has undergone the steeping process, there is nothing more required to whiten it than washing it well in pure water. Dr. Thomson, whose opinion on this subject is of great weight, says, (Ann. Phil. VI. 230,) that he considers this invention as the greatest improvement ever introduced in the linen business, and, *as likely to occasion a total change in the whole of our bleach-fields!* I am of opinion, however, that this will not altogether preclude the necessity of bleaching, however much it may facilitate it; for cotton, which is never steeped, and, besides, is much whiter naturally than the best flax, requires to undergo the bleaching process.

ENGLISH PATENTS.

To John George Bodmer, *of Oxford-street, Charlton Row, in the parish of Manchester, in the county of Lancaster, Civil Engineer, for his invention, and perfection, of certain improvements in the machinery for cleansing, cording, drawing, roving, and spinning of cotton and wool.*

The improvements proposed under this patent, have two principal features, viz. 1st, a more advantageous mode than has heretofore been practised, of preparing and supplying the rovings of cotton or wool, for the feeding of mules, throstles, and other spinning machines; and, 2ndly, in certain contrivances for producing the requisite movements, for running backward and forward the carriage of a mule, and giving the variable velocities to the spindles in the different parts of the operation.

The patentee has extended his specification to a most immoderate length, having filled *thirty-four closely written skins of parchment*, with the details of his contrivances, which are, of course, much too elaborate for us to repeat. Our readers will, however, lose nothing material, in our version of the subject, for this lengthened treatise consists principally in descriptions of well known machines, to which the improvements are proposed to be adapted.

In the first place, the invention is described as connected with a blowing or scutching machine, in which the rough cotton or wool is to be cleansed, preparatory to spinning; that is, divested of its dust, and other impurities. The material about to be operated upon, (having been previously opened, or separated, by the means usually employed in the first process of preparation,) is passed by an endless web to a pair of guide rollers, which conduct it forward through three pairs of drawing rollers, where the filiaments are extended, and the material drawn out about fifteen times, as in the ordinary drawing process. From thence the filiaments pass through the blowing, or scutching apparatus, where they are scraped, or beaten, by a series of indented ledges, standing in a radiating position, upon the periphery of a rapidly revolving drum. By these means, any dirt which adhered to the cotton, or wool, is beaten off: and at the same time, a very strong current of wind, produced by fans, within the drum, acting upon the cotton or wool, blows the dust through a grating below, and thereby cleanses the material thus operated upon.

The force of the wind produced by the rotation of the drum, carries the light filiaments of cotton or wool forward, into a chamber, which, from the wind passing up it, the patentee calls a chimney; this chimney is divided into several compartments, by vertical partitions, and hence the cotton is separated into as many distinct breadths of sliver, as there are compartments. The extreme ends of these breadths of sliver, having been carried forward, by the current of wind, into the chimney, now fall upon traversing endless bands, and are, by means of those bands, conducted to another system of drawing rollers.

where the filiaments are further drawn, and elongated from nine to twelve times.

At this point of the operation, the first improvement above-mentioned takes place, which consists in the employment of a series of guide rollers, placed at an oblique angle to the drawing rollers, by means of which, the course of the filiaments of cotton or wool, conducted from the drawing rollers through spouts, is made to deviate from its previous straight direction, and being from them carried downwards on to another traversing web below, the lengths of filiament are made to proceed in a horizontal course, at right angles, to that in which they had been drawn, and are ultimately coiled round, or lapped with the cloth that brings them forward on to a cylindrical roller. The particular object of turning the directions of the filiaments, is stated by the patentee to be this—"If an inequality of thickness takes place in the sliver, by turning it at right angles, the inequality becomes divided."

In a similar way, the slivers from a number of carding engines may be conducted off at right angles, by means of endless bands, and be delivered to a lapping engine, for the purpose of coiling them upon a cloth, round a cylindrical roller; the carding engines being all connected together, and actuated simultaneously by straps or bevel gear.

The rollers, when thus covered with the cloth, and the rovings of cotton or wool, are to be placed in convenient situations for feeding the drawing rollers and spindles of mules, throstles, or other spinning machines, instead of feeding the said machinery from copts, or bobbins, as usual; and for the better effecting of that object, the roller thus covered with cotton or wool, is to be placed upon two other revolving rollers, which will cause it to turn round by the friction of the surfaces, and by that means, uncoil and deliver the rovings, as may be required.

The second feature of the invention, as we stated above, consists in a method of moving the carriage of the mule backward and forward. The patentee precedes the explanation of this contrivance, by a description of the ordinary mode of working the mule, and then states, that instead of the usual band and wheel employed for driving the carriage, he connects the carriage to the standard, or frame, by means of a series of levers, combined in the way of lazy-tongs: one end of the lazy-tongs being attached to the carriage, and the other to the standard.

At the end of the axle of the delivering rollers that receive and guide the rovings, there are some bevel-wheels attached, which, as they revolve, move a cam, or fusee, and this cam, acting against the legs of the lazy-tongs, according to its position, opens or shuts them, and, consequently, causes the carriage to advance, or recede, as the lazy-tongs elongate or collapse. Notwithstanding the extravagant length of the specification, this part of the invention is not described in the clearest possible way. The intention and action of such an apparatus, may, however, be easily understood, and as to the details of the other parts of the machinery, they appear to be all of them common to ordinary spinning apparatus, and, therefore, need not be enlarged upon here.—*Enrolled March*, 1825.

[*Lon. Jour. of Arts and Sciences.*

Specification of the Patent granted to THOMAS HANCOCK, *of Goswell Mews, in the parish of Saint Luke, Old-street, Middlesex, Patent Cock Manufacturer, for a new or improved manufacture, which may in many instances be used as a substitute for leather, and otherwise.* Dated March 15, 1825.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Thomas Hancock, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained as follows, (that is to say:)—My said invention consists in filling, saturating, and combining various fibrous substances, in their manufactured and unmanufactured state, with a composition which leaves to the fibres sufficient flexibility, and at the same time unites and consolidates them into one mass, thereby increasing their strength and durability, and producing, by these means, a manufacture which may be in many instances substituted for leather, and be applied to other useful purposes, such as soles for shoes and boots, hose, pipes, pails, and other articles which have heretofore been made of leather; and also to other useful purposes, such as the roofs of virandas, corn and flour sacks, packing cloths, and tarpaulings. The fibrous substances I employ in this manufacture are wool, cotton, hair, silk, flax, hemp, carded, combed, or hackled, and combined with the same substances, woven and manufactured. As the same process is applicable to all the combinations, it will be necessary to describe the method I pursue in one case only, as any variation may be made in arranging the different substances, at the discretion of the operator:—I take a piece of cotton cloth, of any convenient size, and strain it on a board, and spread over it, with a spatula, or other convenient instrument, a full coating of one of the compounds to be hereafter described. I then spread on, or over, the compound a layer of carded cotton, somewhat similar to the article known by the name of wadding, spreading over this again another piece of cotton cloth, prepared as the first. I then submit the whole to sufficient pressure between boards, or plates of metal, either passing them through or between rollers or otherwise, to force the composition quite through the layer of carded cotton. I then carefully remove it from the boards or plates, and leave it to dry either in the open air, or in a warm room, heated to eighty or ninety degrees of temperature, and proceed to make others in the same manner. When I perceive that they are nearly or quite dry, I again submit them to the press; or if one of these strata is not sufficient to make up the thickness I require, I put two, three, four, or more together, spreading the said compound on the surfaces again if necessary.

and increasing the pressure. After they have been in the press some hours, they may again be exposed to the air, or returned to the warm room, to complete the drying, and if necessary, pressed again. When I wish to have the carded cotton for either or both surfaces, I carefully separate, at the end of two or more pressings, the last layer or layers of cloth from the cotton below it, soon after I take it out of the press, as it will then separate, and proceed as before described. In this manner I introduce into this manufacture, hair, wool, silk, hemp, and the like, or any mixture of these fibrous substances, or any or all of them, mixed with chopped hemp or tow, and carded together; or I hackle or comb hemp or flax, and lay the fibres parallel with each other, and combine any intermixture of these different materials with the different kinds of manufactured wool, silk, linen, cotton, and the like, according to the purpose to which the article is to be applied, or as economy may dictate. For soles of shoes and boots, I prefer wool, hair, and cotton, in about equal proportions. For hose, pipes, pails, and accoutrements, chopped hemp, tow, and cotton. I prefer the woven materials to be made of wool or cotton, and these of an open, loose, and coarse texture, excepting where it is intended for a finer surface; in such cases I choose the fabric of a finer quality. If the article is required to have a smooth surface, I produce it by using polished metal plates, the last time the article is pressed. I make the compound, or compounds, with which I unite or combine the said substances, as follows:—(No. 1.) I take two pounds of caoutchouc, dissolved in one gallon of equal parts of oil of turpentine, and highly rectified coal tar oil, six ounces of black resin, two pounds of strong glue size, and one pound of ochre, powdered pumice, or whiting, and mix the whole together; or (No. 2.) one pound and a half of caoutchouc, dissolved as before stated; one pound of strong glue size. I melt and mix the resin and size in a water or steam bath, and then add the other ingredients, stirring the whole until it is mixed throughout. The solution of the caoutchouc is expedited by a water or steam bath, and the undissolved portions may be separated by straining it through a fine wire or other sieve. The mixture (No. 1.) is applicable to articles where stiffness and cheapness are required. No. 2, is preferable when pliancy and strength are more required. But I think it proper here to state, that the proportions above mentioned may be varied according to the different applications of the article to be manufactured. If varied qualities of stiffness, or cheapness, should be desired, the proportions of size and whiting may be increased till they make up one-third of the mass. If flexibility be required, the quantity of dissolved caoutchouc in the compound No. 2, may be increased, and especially where great strength and pliancy are required. This last is also preferable for articles that are to be much exposed to the weather.

[*Repertory of Patent Inventions.*

Patent granted to THOMAS MUSSELWHITE, *of Devizes, Saddler, for improvements in the manufacture or construction of collars for horses, or for other animals.* Dated July 16, 1825.

The collar described in the specification of this patent, differs from those in common use; first, in being made to open at the top, to facilitate its being placed on the horse's neck; secondly, in having two oval iron bows introduced in the external part of the stuffing, to make it preserve its shape, more unalterably; thirdly, in a cane bow, attached to a piece of leather, properly shaped, being fixed in it close before the anterior iron bow, to keep the hames more firmly in their place; and fourthly, in having two large pieces of cork, formed so as to fit the shoulder of the horse. introduced, one at each side, into the stuffing.

The fore iron bow, is fixed in front of the collar, so as to lie partly under the hames; and the back iron bow, which is made considerably stronger is placed two or three inches behind the first, parallel to it, and nearly where the collar begins to bend round sideways to the horse's neck. The two iron bows are kept together by an iron pin, rivetted at right angles to the bottom of the front bow, which passing backwards through a hole in the bottom of the other bow, is there pressed against it by a nut, that is made to screw on it for this purpose; and behind the nut a ring is represented in the drawings of the specification, though not mentioned in the description; the top extremities of the back bow are formed into two loops, through which a strap runs, that by its buckle closes it tight, above the horse's neck; and the upper ends of the front bow are either closed by a "turn buckle," or some similar means. The purpose of the other parts mentioned, are explained above, and ample directions are given by the patentee for shaping the various pieces of leather, and putting them together, which, with these altogether, constitute the collar. We cannot say so much for an instrument intended to take measure of horses' necks, which is described in the specification in too general terms, to convey any precise ideas of its formation, little more being said of it, but that it is composed of curved pieces of brass, graduated so as to assist in recording the exact form of the neck, and that the patentee finds it very useful for this purpose.

It appears to us that this collar is well contrived to preserve its shape, and be very compact, firm, and durable. The addition of the cork to the stuffing, seems a judicious improvement, calculated not only to maintain the form of this part, but to keep the horse's neck cool, which we think a material consideration. As no joints are represented in the iron bows, we suppose they must open by their elasticity; but joints at their lower parts, where the pin passes through them, would also have the same effect.

Good, well fitting collars, are of more consequence than is imagined, there being great reason to suppose that the lives of horses have often been sacrificed to defects in these particulars; which making them press too much on the great veins that lead from the head of the animal, when the draft is severe, cause the blood to be forced too largely into the brain, where, if it does not occasion apoplexy, as not unfrequently happens, it produces other disorders, no less fatal in the end.

Collars may be also contrived so as to throw the principal pressure of the draft, on the front of the horse's breast, below the windpipe, which would have the good effect of preventing compression of the great veins, as well as of this latter organ; and we refer for a plan for this purpose, to our 17th vol. Second Series.—[*Ibid.*

Specification of the Patent granted to John Martineau, *the younger, of the City Road, Middlesex, Engineer, and* Henry William Smith, *of Laurence Pountney Place, London, Esq., for certain improvements in the manufacture of steel. Communicated to them by a Foreigner.* Dated October 6, 1825.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said John Martineau, the younger, do hereby declare the nature of the improvements, so communicated to us as aforesaid, to consist in adding to, and mixing, or combining with, blister steel, or such other steel as is ordinarily used in cast steel works, such alloys, and in such proportions as will greatly improve the quality of the said steel, and will enable the manufacturer to produce in goods made of the said alloyed steel, the beautiful wavy appearance exhibited on the best Damascus sword blades. This said alloyed steel, we call meteor steel; and, in further compliance with the said proviso, I, the said John Martineau, the younger, do hereby describe the manner in which the said improvements so communicated to us, as aforesaid, are to be performed as follows (that is to say): twenty-four parts of zinc, four of purified nickel, and one of silver, are put into a black lead, or other refractory crucible, the surface being covered with charcoal powder, the cover is to be luted on, and the whole subjected to the heat of a steel furnace, until it is fused; the mixture, when melted, is then poured out into cold water, so as to render it brittle, and more easy to pound into small pieces for use. This we call meteor powder, and although we have found these proportions of the different metals to be the best for general purposes, yet we do not confine ourselves to these precise quantities, a small variation affording a scarcely perceptible difference in the results. Having produced our meteor powder, in manner aforesaid, we next proceed to make our meteor steel; in the process of making which, we charge our crucibles, which are of the usual size, form, and fabric, with the following ingredients, and in the following proportions, (that is to say,) twenty-four pounds of blister steel, or such other steel as is used in cast steel works, eight ounces of meteor powder, pounded very small, six ounces of pounded chromate of iron, one ounce of charcoal powder, two ounces of quick-lime, and two ounces of porcelain clay. The above proportions produce a steel of an excellent quality, and capable of exhibiting the said wavy appearance in a beautiful manner, but we vary somewhat the proportions of meteor powder, according as more or less of this wavy appearance is required. The quantity of charcoal must also be somewhat varied, according as a harder or softer steel is required, and according as the blister, or other steel used for charging the crucible, is more or less converted; these are points which may be safely left to the experience of any ordinary steel caster. The quicklime and porcelain clay being only used as fluxes, may be varied in quantity, without injuring the process, but the proportions hereinbefore described, are the best we have as yet discovered. The furnaces and crucibles, at present in use in cast steel works, may be used in the manufacture of the meteor steel, and the said steel, when made as aforesaid, may be cast and tilted in the usual manner. In order to draw out and exhibit the said wavy appearance upon any article manufactured with this steel, the surface, when polished, should be rubbed over with any acid which readily acts upon steel, and according as the wavy lines are required to be more or less conspicuous, so the surface is to be kept moistened with the said acid for a longer or shorter period. As soon as a sufficient effect is produced, the acid must be carefully washed off; various acids will answer for this purpose, but we prefer a mixture of one part nitric acid to nineteen parts of distilled or French vinegar. Now, whereas, we do not claim exclusive right or privilege to any of the apparatus hereinbefore described, as used in the manufacture of the said meteor steel, but only to the mixed metal produced by the combination of steel, zinc, purified nickel, and silver, and chromate of iron, in manner hereinbefore described, and which mixture constitutes the said improvements so communicated to us, as aforesaid; and such improvements being, to the best of our knowledge and belief, entirely new, and never before used; I, the said John Martineau, the younger, do hereby declare this to be our specification of the said improvements, and that I do verily believe this our said specification doth comply in all respects fully with the proviso in the hereinbefore recited letters patent. Wherefore, we do hereby claim to maintain exclusive right and privilege to the said improvements.

In witness whereof, &c.—[*Ibid.*

FOR THE FRANKLIN JOURNAL.

MECHANICAL JURISPRUDENCE.—No. XI.

BY PETER A. BROWNE, Esq.

On the law of Patents for new and useful Inventions.

Under the second general rule, with respect to patents, namely, that the invention, or discovery, must be *new*, there are several particular rules, which require attention.

1. *The inventor must not allow it to be used by any one, before he takes out his patent.*

My Lord Coke says, (3 Inst. 184,) "A patent must be of such manufacture, or process, as no other did, at the time of making the letters patent, use; for though it be newly invented, yet, if any other did use it, at the time of making the letters patent, it is void, by the statute."

2. *The inventor cannot make sale of the article invented, or discovered.*

In the case of Wood v. Limmer, 1 Holt's N. P. Reports, 58, which related to a patent for a new mode of making verdigris, one of the objections was, that the invention was in public sale, by the patentee, before the grant of the patent; and Gibbs, Chief Justice, on that occasion, said, "Some things are obvious as soon as they are made public; of others, the scientific world may possess itself by analysis; some inventions almost baffle discovery. But to entitle a man to a patent, the invention must be *new to the world.* The *public sale* of that, which is afterwards made the subject of a patent, *though sold by the inventor only*, makes *the patent* void."

3. *It will not alter the case if it has been used in secret.*

In the case of Tenant's patent, for a bleaching liquor, Lord Ellenborough non-suited the plaintiff, and one of the grounds was, that the process had been known five or six years before, to five persons, and had been by them used in secret. See Davis on Patents, 429.

4. *In the United States, the discovery should be unknown, and not used as the invention of any other than the patentee, before the application for a patent.*

Huntington sued Moore in the Circuit Court of the United States, for the Southern District of New York, in April, 1824, for an infringement of a patent issued to the plaintiff in May, 1822, for an improvement in the stop-cock. Evidence was given by the plaintiff, showing the time of the invention to be September, 1815. It appeared that the plaintiff had taken out a patent, in 1816, for "*an improved block-tin stop-cock*," the description of which corresponded with the one in the patent of 1822; but, in the former patent, the particulars claimed, were not designated, as done in the latter. It also appeared, that certain parts of the instrument, described generally, as part of the instrument in both patents, but not claimed in the patent of 1822, as improvements of the patentee, had been in use prior to the patent of 1815.

The defendant moved for a non-suit, and one ground was, "that the instrument had gone into use before the date of the patent of 1822, on which the suit was brought."

Judge Thompson, after expressing a wish that these questions, which he considered of much importance and difficulty, had come before him in a way which would have allowed more time for consideration, proceeded to express his opinion to the following effect.

He stated the first question to be, whether the fact, that the invention had been introduced into use by the patentee himself, as his invention, prior to the application for the patent, rendered the patent invalid.

That it appeared to be settled law in England, that if an invention had been introduced into use by the patentee himself, and made known, and used by others, before the date of the patent, such disclosure, and use, would destroy the patent.

That there was, however, a difference between the English law, and the acts of Congress, on this subject.

In the English statute, it is stated precisely, from what period the fourteen years are to commence—they are to run from the date of the patent; there is no such phraseology in the act of Congress. That the English statute, speaks of the invention to be patented, being such as others before the date of the patent, shall not use; and, consequently, if a patentee in England has so disclosed his invention, as that it be put in use before the date of the patent, he is not entitled to the patent. Our acts do not contain these provisions.

That there was some incongruity in the phraseology of our patent law of 1793; that it was inartificially drawn, in several parts, and that a correct interpretation of it, required the general scope and object of the law, and all the clauses, to be taken into view together. That if no other part of the act than the first section were to be read, it would seem to preclude a patent for any invention used before the application for a patent; but that, taking a general view of the clauses of the act, and of its object, he thought that this section must be controlled by the other parts of the act. That, as it respected the patentee, the great object of the law was, to secure to inventors the benefit of their inventions, for fourteen years; the third section, prescribing the oath to be taken, only speaks of the applicant being the true inventor; it says nothing about the invention not having been in use before the application. So also the sixth section, which specifies the causes for which a patent may be declared void, shows the great object of inquiry to be, whether there was a prior use of the improvement; prior to what? Prior to the invention of the patentee. The same remarks are applicable to the tenth section; and, indeed, such seems the fair import of all the sections of the act of 1798, but the first. He therefore thought, that the first section should be construed in connexion with the other parts of the act, to mean, that the improvement, or discovery, should be unknown, and not used as the invention of any other than the patentee, before the application for a patent.

5. *According to the British laws, a patent may be granted to the first inventor, if the invention be new* IN ENGLAND, *though the thing was before practised* BEYOND SEA.

This arises upon the peculiar wording of the statute, which speaks of new manufactures *within the realm.* The case of Edgeberry v. Stevens, 1 Salkeld, 447, and Combuback, 84, before cited, establishes this point.

The words of the act of Congress are different from those of the English statute. The first section says, "Any *new* and useful art, &c.,*not known, or used, before the application.*" The sixth section declares, "that, if the defendant, in any action brought for a breach of the patent, shall prove that the thing, thus secured by patent, was not originally discovered by the patentee, *but had been in use*, or *had been described in some public work, anterior to the supposed discovery of the patentee*, judgment shall be rendered for the defendant."

6. *The words in the act are general, as to place; and, therefore, in the United States, no patent is valid if the thing patented has been in use, in* THIS, *or any* FOREIGN COUNTRY, *or has been described in an American, or foreign public work, prior to the time of the supposed discovery.*

Oliver Evans instituted a suit against one Eaton, for a violation of his patent right for his improvement in the art of manufacturing flour, by means of an elevator, conveyer, hopperboy, drill, and kill drier. The defence principally relied on, was, that the hopperboy had been used in certain mills in the United States, anterior to the supposed invention. The plaintiff gave evidence of his discovery in 1783, and of its being brought into use in 1785. The defendant produced a number of witnesses, who described a machine, called Stouffer's machine, or hopperboy, which had been in use, in many mills, from the year 1764, and which, they deposed, was the same as the hopperboy.

The plaintiff contended, that it was not necessary that he should be the *first* discoverer, if he was the real *bona fide* discoverer, without knowing that a similar discovery had previously been made; this, he argued, was clearly the meaning of the word "true," in the tenth section of the act of Congress, with which, he said, the word "original," in the sixth section, is synonymous. That the word "first," which was used in the British statute, was, no doubt, dropped intentionally by Congress.

But Washington, Justice, in his charge to the jury, said, "The discovery must be not only useful, but *new*. It must not have been *known*, or *used*, *before*, *in any part of the world*. It is contended by the plaintiff's counsel, that the title of the patentees cannot be impeached, unless it is shown, that they knew of a prior discovery of the same art, machine, &c.; and, that true, and original, are synonymous, in the intention of the legislature.

"As it is not pretended that true, and original, mean the same thing in *common parlance*, I proceed to inquire, whether the *legislature* intended to use them as such. As to this, there can scarcely be two opposed opinions. The first section, referring to the allegations of the applicant for a patent, speaks of a discovery, as something not known or used before the application. And in the sixth section, it is declared, that the defendant may give in evidence, that the thing secured by patent, was not originally discovered by the patentee, but had been in use, or had been described in some public work, anterior to the supposed discovery. Now, if *original* does not mean *first*, the preceding expressions, in the first and sixth sections, most certainly do."

This case was afterwards brought before the Supreme Court of the United States. 3 Wheaton's Reports, 454. Chief Justice Marshall (page 513) delivered the opinion of the Court, on this point, as follows:—"The plaintiff has also contended, that it is not necessary for the patentee to show himself to be the *first* inventor, or discoverer. That the law is satisfied, by his having invented a machine, although it may have been previously discovered by some other person.

"Without a critical inquiry into the accuracy with which the term invention, or discovery, may be applied to any other than the *first* inventor, the Court considers this question as completely decided by the sixth section of the general patent act.

"That declares, that 'if the thing was not originally discovered by the patentee, but had been in use, or had been described in some public work, anterior to the supposed discovery of the patentee, judgment shall be rendered for the defendant, and the patent declared void.'

"Admitting the words '*originally discovered*,' to be explained, or limited, by the subsequent words; still, if the thing *had been in use*, or had been *described in a public work*, anterior to the supposed discovery, the patent is void. It may be that the patentee had no knowledge of this previous use, or previous description; still his patent is void: the law supposes he *may* have known it."

7. *Though the law requires, that the invention shall be new, yet a patent will be available, for a machine comprehending a* NEW COMBINATION *of parts, although all the parts may have been* REPEATEDLY *used in former machines*

In Boulton and Watt v. Bull, Buller, Justice, observes, that "mechanical and chemical discoveries all come within the description of manufactures, and that it is no objection to either of them, that the *articles* of which they are composed, were known, and were in use before, provided the *compound article*, which is the object of the invention, is *new*."

In 1803, Huddard sued Grimshaw, in the King's bench of England, to recover damages for the violation of a patent for a new mode, or art, of making great cables, and other cordage, so as to obtain a greater degree of strength therein, by a more equal distribution of the strain upon the yarns.

It was objected, among other things, to this patent, that it was, in part, *not new*.

Lord Ellenborough, in his charge to the jury, expressed himself, upon that point, as follows:—"In inventions of this sort, and every other, through the medium of mechanism, there are some materials which are common, and cannot be supposed to be appropriated in the terms of *any* patent. There are common elementary materials to work with in machinery, but it is the adoption of these materials, to the execution of any particular purpose, that constitutes the invention; and if the *application* of them be *new; if the combination in its nature be essentially new;* if it be productive of a *new end*, and beneficial to the public, it is that species of invention, which, protected by the King's patent, ought to continue to the person, the sole right of vending it."

8. *The combination must be new, from the beginning.*

In the case of Bovill v. Moore, 2 Marshall's Reports, 211, the plaintiff claimed as assignee of a patent granted to John Browne, for a machine for manufacturing of bobbin lace. The specification described the nature of the invention, and in what manner the same was to be performed, by six plans, or drawings, thereto annexed, which represented the different parts of the machine, and different views of the whole. The merit of the invention consisted in the mode of supplying the warp, and diagonal threads, respectively. The defendant proved, that up to the point where the perpendicular threads cross each other, the operation of the machine was similar to the *old* machines, and particularly to one of Heathcote's. Chief Justice Gibbs told the jury, that if they thought Browne had invented a *perfectly new combination of parts from the beginning*, though all the parts, *separately*, might have been used before, his specification would be good.

This opinion was confirmed on a motion for a new trial, when the Chief Justice added, "that it was not immaterial to consider, that the drawing, or plans, of the machine, were divided into six different sections, and as to one of them, the witnesses said that it existed entirely in the old machine; and that a machine carried no further, would have been a very useful invention."

9. *In order to give the patent validity,* AS A COMBINATION, *it must appear that* NONE *of the parts have ever before been used,* COMBINEDLY, *in any other machine.*

This was also decided in the case last cited, for the Chief Justice added, that if the jury should be of opinion, that a combination of a certain number of these parts, had previously existed, up to a certain point, and that Browne had taken up his invention from that point only, adding other combinations to it, it was bad.

And in Barrett v. Hall, 1 Mason's Reports, 476, Judge Story lays down the rule explicitly, that where a combination of machinery already exists, up to a certain point, and the patentee makes an addition, or improvement, to the machinery, he must confine his patent to the improvement; for if he takes a patent for the whole machine, as improved, not distinguishing between the new and old, nor limiting his patent to the improvement, it is void; because, as so claimed, it is not his invention.

10. *The patentee must be careful to take his patent for the* COMPOUND, *and not for the* ARTICLES *of which it is composed.*

This is stated upon the authority of Buller, Justice, in the case of Boulten and Watt v. Bull, who says, "But then the patent must be for the specific compound, and not for all the articles, or ingredients, of which it is made."

11. *In an action brought for the breach of a patent right, the plaintiff must prove the invention to be new.*

In 1816, Borill sued Moore, and others, for an invasion of his patent for a machine for the manufacture of bobbin lace. Lord Chief Justice Gibbs charged the jury thus:—"In point of law, it is necessary that the plaintiff should prove, that this is a new, and useful, invention, in order to entitle himself to the present action."

THE ARTISAN.—No. I.

Observations on Specific Gravity, by the EDITOR.

Under the head of "the Artisan," we intend to give popular illustrations of scientific subjects; selecting, in general, those which are more immediately applicable to the purposes of the artisan, and the manufacturer. These papers will be sometimes original, and at others, selected. The contributions of our correspondents, will, when suitable, be placed under this head. Some of the essays with which we have been favoured by Dr. Hare, are of this character; more particularly, that upon specific gravity, in our first number, and his "Illustrations of atmospheric pressure." To these we now add three others, ON HYDROMETERS, ON NICHOLSON'S GRAVIMETER, and ON THE BUOYANCY OF AIR. These papers are not meant as contributions to the stock of knowledge possessed by those who are habituated to the pursuits of science, but are intended to diffuse some acquaintance with its principles and processes, among practical men, to whom it may prove a valuable auxiliary, in their respective occupations.

HYDROSTATICS, *is that branch of science which explains the effects produced by non-elastic fluids,* (liquids,) *in consequence of their weight, or pressure.* It is in consequence of this pressure, that certain bodies float upon the surface of liquids; most of the different species of wood, float upon water, and most of the metals, upon quicksilver. The ascertaining of the specific gravity of different bodies, is an Hydrostatical operation.

By *Specific Gravity* is meant the weight of different kinds, or species of matter, when compared with some other kind or species as a standard: but in order to effectuate this, it is necessary to compare equal bulks of each, as their relative weights cannot otherwise be ascertained. It is altogether unimportant what these bulks are, for if a gallon of quicksilver, be fourteen times the weight of a gallon of pure water, it is evident that a gill of the metal, will also be fourteen times as heavy as a gill of water.

Water has been adopted as the standard with which other substances are compared; various reasons might be assigned for this choice, but the following will be sufficient to satisfy every one, of its peculiar adaptation to the purpose. Water can be obtained in all habitable situations; rain water is sufficiently pure, for the operation, and any kind of water may be made so, by distillation. This fluid being easily rendered pure, and sustained at a medium temperature, say 60° of Fahrenheit's Thermometer, affords an article, which at all times, and in all places, will be of the same density; that is, equal bulks, will be, precisely, equal in weight.

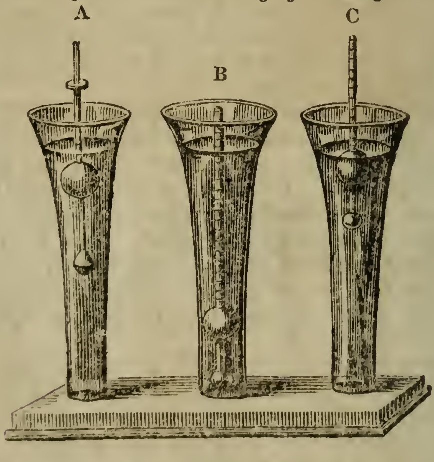
From the preceding remarks, it must be evident, that the specific gravity, of any body may be expressed in numbers, without regard to its absolute weight. The numbers, representing, simply, how many times heavier, or lighter than an equal bulk of water, the article is, which is under consideration, whether it be a solid, a liquid, or an air; and if in a table of specific gravities, we find gold marked 19, and lead 11, we know that any portion of either, will be found to be so many times heavier, than an equal bulk of water. Articles lighter than water, must, of course, be expressed in fractional parts. Should we find cork stated to be 0.25, which is equivalent to $\frac{1}{4}$, we know that another piece of cork, whatever its size, weighs one-fourth as much, as an equal bulk of water; the two portions of cork being supposed to be alike in density.

Several methods for finding the specific gravity of solids, are detailed in the paper of Professor Hare, to which we have already alluded. Those on the *Chyometer*, and *Litrameter* explain the application of those instruments, in ascertaining the specific gravity of liquids, and the first of the subjoined communications, relates, principally, to instruments ordinarily used for the same purpose. The second, exhibits the use of Nicholson's Hydrometer, or Gravimeter, in ascertaining the specific gravity of solids.

Various other Hydrometers have been constructed, and are used for different liquids, and in different countries; but it will be seen that whether known under the name of *Hydrometer*, *Essay Instrument* , *Pese-liquer*, *Areometer*, *Gravimeter*, *Alcohometer*, or *Saccharimeter*, they all operate upon the same principle, and serve as measures of the density of different liquids. They are made of different materials, and are differently graduated, so as to adapt them to particular fluids: for acids, and other corrosive liquids, glass is always used, and but for its brittleness, it would be preferable, in most cases.

This subject will be resumed in a future number, as several remarks, which we had intended to make, are omitted, in order to prevent the extension of the present article, to an unacceptable length.

Remarks on Hydrometers. By ROBERT HARE, *M. D. Professor of Chemistry in the University of Pennsylvania.*



The above is a representation of three Hydrometers, A, B, and C, contained in glass vessels. B and C are of glass, and A of metal.

B is intended for liquids heavier than water; C, for those which are lighter. In each, the graduation commences at that point of the stem, to which the instrument sinks in distilled water. It must, of course, commence at the top of the stem, for liquids heavier than water; and, at the bottom of the stem, for liquids lighter than water. In the former case, as in that of spirituous liquors, or of ether, the strength being greater, as the liquid is lighter, more of the stem is immerged, in proportion as the liquid is stronger: but, the opposite is true, in the case of acid and saline solutions, or infusions of vegetable matter; the more the stem emerges from these, the heavier, and, of course, the stronger, they are. The instruments are represented, as when swimming in pure water.

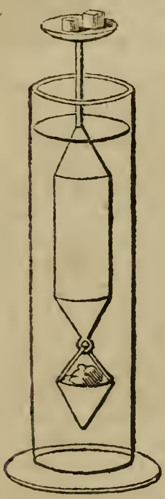
At A is an Hydrometer, of a form much used in this country and in England, both for spirit and for infusions of vegetable matter. The stem is virtually lengthened, by the use of several small weights, which may be slipped on and off at pleasure.

The whole difference, between the weight of water, and that of the strongest spirit, is about two parts of water in ten. Of course, since spirit is lighter than water, an Hydrometer for spirit, should have on its stem a scale of more than two hundred parts, in order to give the specific gravity of every spirituous mixture, of water with alcohol. To render such graduation sufficiently discernible, the stem would have to be of a very inconvenient length. This is obviated, by using different weights. When the heaviest weight is upon the stem, the whole of the stem stands above the surface, in distilled water. When the liquid contains enough spirit to allow the whole of the stem to sink in it, while supporting this weight, a lighter weight may be used; and, when the stem, again, would be wholly immersed, this last mentioned weight may be exchanged for one still lighter. Supposing the stem graduated into fifty parts, three weights would give fifty degrees each; and the stem, unloaded, fifty more. Were the stem graduated into ten parts, nineteen weights would give one hundred and ninety parts; and the stem, unloaded, ten more.

An instrument, sometimes called a Saccharometer, but precisely similar in principle, is used for infusions of vegetable matter, especially for the wort of brewers and distillers—excepting, that the scale begins at the top of the stem, with a line which coincides with the surface of pure water, at sixty degrees Fahrenheit, when the Hydrometer is immersed in it. When the infusion is strong enough to support the whole of the stem above its surface, a weight is to be added, heavy enough to bring the graduated part of the stem into the liquid. And, in like manner, as the infusion is found stronger, weights still heavier must be added, the process being perfectly analogous to, but, the converse of that, described in the case of alcohol. In either case, the weights must form a series, each number of which differs from that next to it, by a weight equal to that of a quantity of the liquid which it is destined to assay, equivalent in bulk to the graduated part of the stem.

As each weight is destined to assay a liquid, of a different gravity, and as the graduated part of the stem, displaces always the same bulk, it follows, that the difference between the weights must be less, in proportion, as the liquid, for which they are intended, is lighter; and greater, as it is heavier.

On the Use of Nicholson's Gravimeter, in ascertaining the Specific Gravity of Solids, either heavier, or lighter, than water. By Robert Hare, M. D.



The accompanying cut is a representation of Nicholson's Gravimeter, the construction of which is sufficiently obvious.

On the upper scale of the instrument, whilst floating in water, place any body, the specific gravity of which is to be found—a piece of coin, for instance—and add as much weight to the same scale, as will sink the Gravimeter, until a mark, purposely made in the stem, coincides with the surface of the water. The coin is then to be transferred to the lower scale, and as much weight added to the upper one, as compensates this change. This weight is obviously just equivalent to the resistance which the coin encounters, in sinking in water. Let this weight be called A.

In the next place, the body is to be removed from the Hydrometer, and as much weight (B) again added to the upper scale, as will cause the mark upon the stem to coincide with the aqueous surface. Of the weight first employed, no account need be taken; but, the weight A, and the weight B, used in the second and third steps of the process, are to be carefully noted, and added together; the sum of A and B is then to be divided by A, the first noted number. This number A, represents the weight of a bulk of water, equal in bulk to the coin; while the sum of the numbers (A and B) is equivalent to the weight of the coin: since that aggregate weight has been found equivalent to the weight of the coin in sinking the Hydrometer.

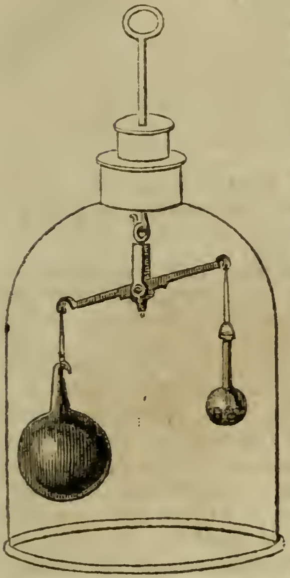
To find the gravity of a body lighter than water, by Nicholson's Gravimeter.

Should the gravity of a light body, as a piece of cork, for instance, be in question, place it on the upper scale of the Gravimeter, load the instrument, so as that the mark on the stem, may coincide with the surface of the water, as in the case above stated; a leaden disk being previously laid upon the lower scale. The cork being removed, the weight requisite to compensate its absence, gives the weight of the cork. This weight, being added to that which will compensate its buoyancy, when immersed in water, by being placed beneath the leaden disk in the lower scale, gives the weight of a quantity of water, equal in bulk to the cork. Hence, if the number of grains representing the weight of the cork, be divided by those representing the weight of its bulk of water, the quotient will be the specific gravity; which, in this case, must be expressed in a decimal fraction, as it is less than unity.

These operations with the Gravimeter might be much facilitated by using measures of water, made by the *Chyometer,* in lieu of weights. In that case, a small receptacle for water, must be attached to the upper scale.

On the BUOYANCY OF AIR. *By* ROBERT HARE, M. D.

A pound of feathers heavier than a pound of lead.



If two bodies, one of which is more bulky than the other, be found equiponderant, in the ordinary process of weighing by a balance, the larger body is the heavier.

Let the bodies in question, be those represented within the receiver of an Air Pump, in the subjoined figure. On withdrawing the air, by means of the pump, it will be found, that the larger body preponderates, though previously counterpoised with accuracy.

RATIONALE.

It has been shown, by the preceding illustrations, that, when any body is surrounded by a fluid, it is buoyed up with a force in proportion to the weight of the fluid, and the quantity displaced by the body. Of course, the more space it occupies, in proportion to its weight, the more will its weight be counteracted. In the case of the two bodies rendered equiponderant, in air, the weight of the larger is most counteracted by the air. Hence, on exhausting the air from the receiver, the larger body shows a preponderancy over the other, equivalent to the superior support which the air had afforded it.

A similar result may be obtained, if hydrogen be substituted in the receiver for atmospheric air; because, as its specific gravity to that of the air, is, only, as 1 to 14, nearly, each body would lose $\frac{13}{14}$ of the support which the air had afforded; but, the larger body having received more, would lose more. It follows, that the common saying, that 'a pound of feathers is as heavy as a pound of lead,' is less than the truth, as they would really prove heavier, were the air removed.

I will take this opportunity of suggesting, that the comparative gravities of the gases might be ascertained, by means of two bodies, counterpoised as in the figure; by ascertaining the rarefaction, or condensation of each gas, which would make them equiponderate in it, as if it were atmospheric air. In that case, the smaller body should be of platina, which, of all bodies, is the heaviest in proportion to its bulk; and the larger should be of glass, as thin as would be competent to sustain the requisite changes of pressure; since I know of no body, equally firm and impervious, which would be as light in proportion to its bulk. The changes of density might be effected by the air pump, or condenser, and would be discernible by means of a gage.

NATURAL HISTORY.

The Common Opossum.[*]

Didelphis Virginiana; Penn. Gmel., &c.

Le Manicou: Feuille, Obs. Peru, iii. 206.
Tlaquatzin: Hernand. Mexico, 330.
Opossum: Lawson's Carolina, 120. Catesby's Carolina, App. xxix.
Sarigue des Illinois: Buff. Sup. tom. vi. pl. 33. Sarigue à long poil, Ibid. pl. 34.
Didelphis Opossum: L. Gmel. Syst. Nat. i. p. 105.
Micouré premier: D'azzara, Quad du Paragua, Trad. Fran. i. p. 244.
Virginian Opossum: Penn. Quad ii. p. 18, No. 217, Shaw, i. part 2, pl. 107.
Didelphis Woapink: Barton, Facts and Conjectures, &c.

Centuries have elapsed, since this species was first observed by European naturalists, and it has long been a frequent theme of admiration and discussion to those of America, yet it is still considered as a sort of anomaly among animals, and the peculiarities of its sexual intercourse, gestation, and parturition, are to this day involved in profound obscurity. Perhaps nothing can more clearly demonstrate the impatience of the human mind, and the reluctance with which men yield to the hard necessity of carefully observing the operations of nature, than the history of this animal. Volumes of facts and conjectures have been written on the subject, in which the proportion of *conjecture* to *fact*, has been as a thousand to one, and the difficulties still remain to be surmounted. The animal is among the most common within our borders, and is annually killed, or captured, in large numbers; faithful investigations into the habits of a few individuals, would be sufficient to settle all doubts for ever, and yet these still remain to be made. Very full and interesting observations have been made at almost every other period; but the great question, how the helpless offspring, weighing scarcely a grain, are conveyed into the external pouch, and attached to the teat of the mother, has never been properly answered.

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[*] From Vol. 2, of Godman's Natural History;—not yet published.

The opossum is very remarkable from other peculiarities, besides those which relate to the continuation of its kind. In the first place, we have already seen, that it has a very large number of teeth,[*] and its hind feet are actually rendered hands, by short, fleshy and opposable thumbs, which, together with the prominences in the palms of these posterior hands, enable the animal to take firm hold of objects which no one would think could be thus grasped. An opossum can cling by these *feet*-hands to a smooth silk handkerchief, or a silk dress, with great security, and climb up by the same. In like manner he can ascend by a skein of silk, or even a few threads. The slightest projection, or doubling, of any material, affords him a certain mean of climbing to any desired height. Another curious and amusing peculiarity, is his prehensile tail; by simply curving this at the extremity, the opossum sustains his weight, and depends from a limb of a tree, or other projecting body, and hanging in full security, gathers fruit, or seizes any prey within his reach; to regain his position on the limb, it is only necessary to make a little stronger effort with the tail, and throw his body upward at the same time.

In speaking of the more obvious peculiarities of the opossum, we may advert to the thinness and membranous character of the external ears, which may remind us in some degree of what has been heretofore said relative to the perfection of the sense of touch possessed by the bat, in consequence of the delicacy of the extended integument forming the ears and wings. The extremity of the nose of our animal is also covered by a soft, moist and delicate integument, which is, no doubt, very sensitive. On the sides of the nose, or rather on the upper lip, there are numerous long, and strong, divergent whiskers, or bristles, projecting to the distance of nearly three inches; over each eye there are two long black bristles, rather softer than the others, somewhat crisped, or undulated, and slightly decurved; while, on the posterior part of the cheek, and about an inch below and in front of the ear, there is a bunch of long, straight bristles, (very similar to those of a hog,) six or eight in number, projecting laterally, so as to form a right angle with the head. When the elongated conical form of the opossum's head is recollected, together with its nocturnal habits, we cannot avoid remarking, that all these arrangements appear to have immediate reference to the safety of the animal, furnishing the means of directing its course, and warning it of the presence of bodies which otherwise might not be discovered until too late.

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[*] In speaking of the Pouched or Marsupial animals, Dr. G. has remarked, that "they are wonderfully unlike all other animals in relation to the production of their offspring, which are brought forth in a condition apparently imperfect or premature. The young, when they are first to be discovered in the external pouch, seem scarcely formed, are incapable of movement, exhibit but slight traces of limbs, or other external organs, are found attached to the teats of the mother, and are unable to resume their hold if it be broken. They remain thus attached until they acquire size and strength enough to move about at will, and continue to take refuge in this curious retreat until they attain the size of a common rat, or are even larger. The pouch is formed by a process, or elongation of the skin of the belly, and is supported by two peculiar bones, which arise from the pubis, and are sustained by the abdominal muscles." Dr. G. observes, on the dental system of the Genus, that they have 50 teeth; 26 in the upper, and 24 in the lower jaw.—[Ed.

The mouth of the opossum is very wide when open, yet the animal does not drink by lapping, but by suction. The wideness of the mouth is rendered very remarkable, when the female is approached, while in company with her young. She then silently drops the lower jaw to the greatest distance it is capable of moving, retracts the angles of the lips, and shows the whole of her teeth, which thus present a formidable array. She then utters a muttering kind of snarl, but does not snap, until the hand, or other object, be brought very close. If this be a stick, or any hard or insensible body, she seldom closes her mouth on it after the first or second time, but maintains the same gaping and snarling appearance, even when it is thrust into her mouth. At the same time, the young, if they have attained any size, either exhibit their signs of defiance, take refuge in the pouch of the mother, or, clinging to various parts of her body, hide their faces amidst her long hair.

The general colour of the opossum is a whitish gray. From the top of the head along the back and upper part of the sides, the gray is darkest, and this colour is produced by the intermixture of coarse white hairs, upwards of three inches long, with a shorter, closer, and softer hair, which is white at base, and black for about half an inch at tip. The whole pelage is of a wooly softness, and the long white hairs diverging considerably, allow the black parts to be seen, so as to give the general gray colour already mentioned. On the face the wool is short, and of a smoky white colour; that on the belly is of the same character, but it is longer on the fore and hind legs; the colour is nearly black from the body to the digits, which are naked beneath. The tail is thick, and black, for upwards of three inches at base, and is covered by small hexagonal scales, having short rigid hairs interspersed throughout its length, which are but slightly perceptible at a little distance. The opossum is generally killed for the sake of its flesh and fat. Its wool is of considerable length and fineness during the winter season, and we should suppose that in manufactures it would be equal to the sheep's wool which is wrought into coarse hats.

The opossum is a nocturnal and timid animal, depending for his safety, more on cunning, than strength. His motions are slow, and his walk, when on the ground, entirely plantigrade, which gives an appearance of clumsiness to his movements. When on the branches of trees, he moves with much greater ease, and with perfect security from sudden gusts of wind; even were his weight sufficient to break the limb on which he rests, there is no danger of his falling to the earth, unless when on the lowest branch, as he can certainly catch, and securely cling, to the smallest intervening twigs, either with the hands or the extremity of the tail. This organ is always employed by the animal while on the smaller branches of trees, as if to guard against such an occurrence, and it is very useful in aiding the opossum to collect his food, by enabling him to suspend himself from a branch above, while rifling a bird's nest of its eggs, or gathering fruits.

The food of the opossum varies very much according to circumstances. It preys upon birds, various small quadrupeds, eggs, and no doubt occasionally upon insects. The poultry-yards are sometimes visited, and much havoc committed by the opossum, as, like the weazel, this animal is fonder of cutting the throats and sucking the blood of a number of individuals, than of satisfying his hunger by eating the flesh of one. Among the wild fruits, the persimmon (*Diospyros Virginiana*) is a great favourite, and it is generally after this fruit is in perfection, that the opossum is killed by the country people for the market. At that season it is very fat, and but little difference is to be perceived between this fat, and that of a young pig. The flavour of the flesh is compared to that of a roasting pig; we have in several instances seen it refused by dogs and cats, although the opossum was in fine order, and but recently killed. This may have been owing to some accidental circumstance, but it was uniformly rejected by these animals, usually not very nice when raw flesh is offered.

The hunting of the opossum is a favourite sport with the country people, who frequently go out with their dogs at night, after the autumnal frosts have begun, and the persimmon fruit is in its most delicious state. The opossum, as soon as he discovers the approach of his enemies, lies perfectly close to the branch, or places himself snugly in the angle where two limbs separate from each other. The dogs, however, soon announce the fact of his presence, by their baying, and the hunter ascending the tree, discovers the branch upon which the animal is seated, and begins to shake it with great violence to alarm, and cause him to relax his hold. This is soon effected, and the opossum attempting to escape to another limb, is pursued immediately, and the shaking is renewed with greater violence, until at length the terrified quadruped allows himself to drop to the ground, where hunters, or dogs, are prepared to despatch him.

Should the hunter, as frequently happens, be unaccompanied by dogs when the opossum falls to the ground, it does not immediately make its escape, but steals slowly and quietly to a little distance, and then gathering itself into as small a compass as possible, remains as still as if dead. Should there be any quantity of grass or underwood near the tree, this apparently simple artifice is frequently sufficient to secure the animal's escape, as it is difficult by moonlight, or in the shadow of the tree, to distinguish it, and if the hunter has not carefully observed the spot where it fell, his labour is often in vain. This circumstance, however, is generally attended to, and the opossum derives but little benefit from his instinctive artifice.

After remaining in this apparently lifeless condition, for a considerable time, or so long as any noise indicative of danger can be heard, the opossum slowly unfolds himself, and creeping as closely as possible upon the ground, would fain sneak off unperceived. Upon a shout, or outcry, in any tone, from his persecutor, he immediately renews his death-like attitude and stillness. If then approached, moved or handled, he is still seemingly dead, and might deceive any one not accustomed to his actions. This feigning, is repeated as frequently as opportunity is allowed him of attempting to escape, and is known so well to the country folks, as to have long since passed into a proverb. "He is playing *'possum*" is applied with great readiness by them to any one who is thought to act deceitfully, or wishes to appear what he is not.

The usual haunts of the opossum are thick forests, and their dens are generally in the hollows of decayed trees, where they pass the day asleep, and sally forth, mostly after night-fall, to seek for food. They are occasionally seen out, during day-light, especially when they have young ones of considerable size, too large to be carried in the maternal pouch. The female then offers a very singular appearance, as she toils along with twelve or sixteen cubs nearly of the size of rats, each with a turn of his tail around the root of the mother's, and clinging on her back, and sides, with paws, hands, and mouth. This circumstance was thought distinctive of another species, hence called *dorsigera*, but is equally true of the common or Virginian opossum. It is exceedingly curious and interesting to see the young, when the mother is at rest, take refuge in the pouch, whence one or two of them may occasionally be seen peeping out, with an air of great comfort and satisfaction. The mother in this condition, or at any time in defence of her young, will make battle, biting with much keenness and severity, for which her long canine teeth are well suited.

If taken young, the opossum is readily tamed, and becomes very fond of human society, in a great degree relinquishes its nocturnal habits, and grows troublesome from its familiarity. We have had one thus tamed, which would follow the inmates of the house with great assiduity, and complain by a whining noise, when left alone. As it grew older it became mischievous from its restless curiosity, and there seemed to be no possibility of devising any contrivance effectually to secure it. The same circumstance is frequently remarked by persons who have attempted to detain them in captivity, and of all the instances which have come to our knowledge, where even a great number were apparently well secured, they have all in a short time enlarged themselves, and been no more heard of. In some such instances these animals have escaped in the city, and for a long time have taken up their quarters in cellars, where their presence has never been suspected, as during the day they remain concealed. In this way it is very probable that many are still living in the city of Philadelphia, obtaining a plentiful food by their nightly labours.

In Dr. Barton's 'facts and conjectures' on the opossum, he mentions as a circumstance worthy of curiosity, the faculty the opossum has of lying on its back. We have observed this action of the animal, but could see nothing in it very different from what is very frequently done by the dog, cat, marmot, squirrel, and various other animals, which occasionally place themselves sufficiently on the back to expose the inferior surface of the body, fully; but that this action in the opossum is indicative of any peculiarity, or is the ordinary position chosen by the animal, is what we cannot state from our own observation.

The length of the full grown opossum is about twenty inches, and that of the tail, twelve; the weight is about fourteen pounds. The number of young is from twelve to sixteen. There is therefore not much probability of the species becoming very scarce, especially as their nocturnal mode of life, renders it by no means necessary that they should fly to very remote distances from the habitations of man.*

FROM THE QUARTERLY REVIEW.

Proposed Expedition to the North Pole. By Captains PARRY *and* FRANKLIN, *jointly.*

It was not to be expected that a man of Parry's activity of mind, and who had so long been engaged in the pursuit of discovery, would be content to remain quietly on shore. He knew that a project had been entertained, by another able and indefatigable officer, of proceeding from Spitzbergen to the North Pole, and he knew that such a man as Franklin, was not likely to suggest and adopt a measure that was not likely to carry with it a chance of success. When two such men as Parry and Franklin, after weighing well the risk to be encountered, and all the circumstances which make for, and against, an undertaking of this nature, offer a plan, for the execution of which they propose to embark themselves, it would surely be something like presumption to affect to undervalue their experience, or to pronounce *their* scheme rash and chimerical.

The President and Council of the Royal Society were clearly of this opinion. In a letter to Lord Melville, they signified their approbation of Captain Parry's proposal, and their opinion that such an enterprise cannot fail to afford many valuable scientific results, and to settle matters of philosophical inquiry; and they concluded by expressing their wishes, that this proposition of so brave, enlightened, and scientific an officer, might meet with the attention it appeared to them to deserve, from the Admiralty.

The Board of Admiralty will scarcely be accused of inattention to any recommendation of this learned body, or of any backwardness in lending its aid toward such undertakings as may have for their object the promotion of science, or the acquirement and extension of useful knowledge. Accordingly, on this recommendation of the proposal of Captain Parry, the Hecla has been ordered to be prepared for the service in question, and to be ready in the early part of next spring. The plan is, as we understand, to proceed in the Hecla to that part of Spitzbergen, called 'Cloven Cliff,' in latitude 79° 52′, so as to reach it towards the end of May. Its distance from the Pole is about 600 miles. This distance is to be performed by means of two boats, so constructed as to be light, tough, and rather flexible; to be furnished with *runners*, in the manner of sledges; and to be covered with leather, like the Russian *baidars*, in which long voyages are performed; to have besides, a covering, or awning, of oil skin, convertible into a sail. Each boat is to be manned with two officers and ten men; and to carry provisions for ninety-two days, which, at the moderate rate of thirteen miles a day, will be sufficient for the performance of the journey to the Pole, and back again to Spitzbergen.

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* It is amusing to read the accounts of the wonderful medical virtues which have been attributed to the tail of this animal, in some of the older writers on the natural history of our continent. The following is a good specimen of the credulity and disposition to deal in the marvellous, which was formerly thought to form an almost essential quality in the natural historian.—"The tail of this animal (says MARCGRAVE) is a singular and wonderful remedy against inflammation of the kidneys: for if it be broken, and the quantity of a drachm of the water in which it is steeped be drunk sometimes, fasting, it wonderfully cleanses the ureters, expels calculi and other obstructions, [excitat venerem, et generat lac, medetur colicis doloribus, prodest parientibus et accelerat partum, promovet menses,] and if it be chewed and placed on a part into which thorns have been thrust, it extracts them, loosens the bowels, and I believe in all New Spain there is not to be found another remedy as useful in so many cases."—*Hist. Ker. Nat. Brasil, lib. vi. p.* 22.

The boats are furnished with runners, in the uncertainty of the intermediate space being ice or water; the probability is, that it will be found to consist of both; in which case, the boats will sail in the water, and be dragged over the ice. Captain Parry proposes to take from Spitzbergen a few dogs, or rein deer, to assist in dragging the boats; both animals will feed on fish, which may perhaps be easily caught; and if their provisions fail, they may become food for the use of the party.

"The practicability," says Captain Parry, "of thus reaching the North Pole, appears to me to turn wholly on the question of resources. This being the case, it would very soon become a matter of scientific calculation, whether or not the object was within the reach of the resources with which the party was furnished; so that they might at any time proceed or return, according to circumstances. In other respects I can perceive nothing whatever that should make it an enterprise of extraordinary risk. The summer temperature of the Polar regions is by no means uncomfortable: the sun would be constantly above the horizon; and our men have always enjoyed remarkably robust health during excursions of this nature. If open water should frequently occur, it is *always sure to be smooth*, and even if it were otherwise, a boat hauled up on a floe of ice, is as sure as on the shore. In fact, the more open water is found, the more easy would be the accomplishment of the enterprise; and taking the chance of such occasional assistance, I cannot but entertain a confident hope, that the whole might be completed by the end of August, and the expedition arrive again in England before the middle of October."

During the three months absence of the Polar party, it is intended to make the boats of the Hecla subservient to the interests of science, by sending out a qualified surveyor, to explore and survey the eastern coast of Spitzbergen, of which, not without shame be it spoken, we are at present wholly ignorant. The party left with the ship might also be most usefully employed in conducting a series of experiments on the pendulum, in making a variety of interesting magnetic observations, in attending to the various meteorological phenomena, and in collecting specimens of natural history. It will also be an object of importance, to ascertain whether new whale fishing stations, may not be discovered on the eastern side of Spitzbergen, to supply the place of those nearly worn out ones, on the western side, from which the whales have either been driven away, or destroyed by the long and constant visits of ships employed in the fishery—just as the Davis' Strait fishery was worn out on the eastern side, and was annually declining, till Parry led the way to the western shore of that Strait, whither the fishing ships now constantly resort, and whence they generally return with full cargoes.

When we call to mind the enterprising expedition of the Baron Wrangel, who was forty days on the ice of the Polar Sea, with sledges not convertible into boats, we confess that Parry's projected journey appears to us divested of any very great danger; doubly provided, as he is to be, he will not be exposed at any rate, to the risk which the Baron experienced, when cast adrift on a pack of ice, and driven about at the mercy of the wind, which fortunately blew him at last *only* to the coast of Siberia.

We verily believe, that on the Pole itself, neither wind nor tide, rain nor snow, thunder nor lightning, will be found to exist; or, if any of them exist at all, it will be found in the smallest possible degree.

Manufactories in Massachusetts.

Merrimack Manufacturing Company, has a capital of $1,200,000, (the whole of which has been paid in,) and was incorporated in 1821. It is situated in the eastern part of Chelmsford, in Middlesex county, near Patucket Falls, and on the canal constructed in 1793, by the proprietors of the Middlesex canal, the first in the United States. The fall of the Merrimack, at Patucket, is thirty feet. The distance north-west from Boston, is twenty-two miles, and from Salem, about the same distance. To the flourishing village of Haverhill, on Merrimack, and nearer to the sea, it is twelve miles.

Five mills have already been erected, containing 4000 spindles each; and three, furnished with proper machinery, are also in operation. Another, with machinery, will be ready the first of January next. About 200 men, and 180 females, are employed in each mill. None are under the age of twelve, and very few are so young. The wages of these persons depend, in some measure, upon their skill and industry. Some earn $2 a week, and others only 1, besides board, which is $1 25. The men receive more. In each mill, 2500 yards are woven daily, of No. 22, 30, and 40 yarn, respectively. All this is bleached; and about three-fourths of it is printed.—Those exhibited in Boston, at the great fair lately, were very fine, and fully equal to those from Taunton, in the opinion of all who examined them.

In the print and bleach work, 50 men and 30 women are employed. The whole work is carried on in the yard, from preparing the colours to the engraving of the cylinders.

An extensive woolen manufactory was established at this place before 1821, and has lately increased in business.

Since the Merrimack Manufacturing Company commenced building, there have been built, in this part of Chelmsford, (now Lowell,) two hundred dwelling-houses, and the village is rapidly increasing.

It may be proper to observe, that in 1825, the proprietors of the Locks and Canals, on Merrimack river, having increased their stock in the sum of $600,000, purchased of the Merrimack Manufacturing Company, all their spare land, and the residue of the water power the latter had created, and also a large machine shop, where machinery for two mills is completed annually. In these, 200 first rate mechanics in iron, wood, &c. are constantly employed. More than a ton of castings is required daily, and furnished by a furnace within four miles. A company, called the Hamilton Manufacturing Company, has recently erected two mills, on land purchased of the proprietors of the Canal and Locks, one of which is in operation. They also have a capital of $600,000; and their buildings are of brick.

The water power of Lowell is great and abundant, and its quality is excellent for bleaching and dying.

The Merrimack is navigable for upwards of a hundred miles above Lowell, and furnishes abundant supplies of wood, lumber, and brick. The communication with Boston is greatly facilitated by the Middlesex canal, by means of which, all heavy articles are transported at a comparatively low rate. The canal packet boat runs three times a week; and a stage goes out, and in, every day, to, and from Boston; besides others to Worcester, Newburyport, Dover, and Concord, N. H. &c. A bridge is also now building over the Merrimack, near the junction with Concord river.

Shepherd Woolen Factory, at Northampton, on Connecticut river. The capital, $130,000—persons employed, 112.—37,500 yards of superfine and second quality of broadcloths manufactured, annually; and in this, 75,000 lbs. of Saxon and American wool, of first quality, are used.

In another factory, belonging to Messrs. Cooks, in Northampton, 10,000 yards have been made in ten months; being about 40 yards a day—for this, about 25,000 pounds of raw wool are worked annually. Much of the work is done by machinery. One jenney in Cook's factory has 100 spindles—three others, 80 each—and a billy with 50 spindles. The capital of this factory we do not know.

[*Boston Commercial Gazette.*

Steam power employed in Great Britain.

The subjoined calculations are from a late number of the *Quarterly Review;* as it serves to give a sensible form, to the estimate of the immense effective power, created by substituting a few hogsheads of water, for a few millions of men, we prefer it to the mere expression of horse power, or of pounds weight, which convey a very inadequate idea to the mind, even in those who are familiar with numbers.

"All the world is more or less acquainted with those immense masses, the pyramids of Egypt, which were considered among the wonders of antiquity. The materials of which the largest of them is constructed, were dug out of the earth at a considerable depth; and at no small distance from their present situation. They cover more than eleven English acres, and are piled up to the height of about 700 feet. According to M. Dupin's calculation, their volume is equal to about 4,000,000 of cubic metres; their weight is 10,400,000 tons; which raised to the height of eleven metres from the bottom of the quarries to the surface of the earth, and of forty-nine more, as their mean elevation above the basis; in all 60 metres above their original level, give 624,000,000 tons raised to the height of one metre.* Now the steam-engines employed in England are equal to the force of 320,000 horses (1820,) and can raise 862,800,000 tons to the height of one metre, in twenty-four hours. But 624,000,000 being less than three-fourths of this quantity, it follows that the steam-engines of England could have raised the materials of which the great pyramid is constructed out of the quarries, could have conveyed them to their present place, and heaped them up in their present form, in less than three-fourths of one day, that is to say, in less than eighteen hours. According to Diodorus Siculus, this building employed 360,000 workmen, according to Herodotus, 100,000 workmen, during twenty years. Whichsoever of these estimates be nearest the truth, it is certain that one of the most powerful monarchies of remote antiquity applied its whole disposable resources in the construction. Therefore the mechanical power of British steam-engines was, in 1820—and it has much increased since that time—to that of the Egyptian monarch Cheops, inversely as the times necessary to each, to perform the same task; that is to say, as twenty years to eighteen hours, or about 10,000 times as great. Neither would it be unfair to deduce from this single fact, that the general power of the two monarchies, including that which is the source of power, knowledge, was, if not exactly in this ratio, at least in a proportion which could not widely differ from it—let us, with great moderation, say one-fourth as great; that is, it is more than probable that the power of England is, at this moment, 2500 times as great as was that of Egypt, at the period when this pyramid was constructed. When we consider the reach of intellect which is necessary to devise the steam engine, in its present state, together with its general influence upon civilization, and the part it acts in national prosperity, it would be impossible for a nation which it has made many times as powerful as another by its direct effect, to be less than one-fourth as great in every branch where its action is only indirect.

"By the power of steam, every machine to which it is applied, receives, not an addition, but a multiplication of force. The power thus produced in 1820 was computed to be equal to 320,000 horses, or about 2,240,000 men. At this moment, steam, on account of its many new applications, and the improvements made in the manner of employing it, may perform the work of near three millions of men in the United Kingdom."

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* The French metre is equal to about 39⅓ English inches.

Remarks on the Slide-rest, by the EDITOR.

The common rest, is a necessary appendage to every turning lathe, and answers perfectly well, in ordinary turning; but where surfaces perfectly flat, rollers perfectly cylindrical, or cones accurately finished, are wanted, it is not merely difficult, but absolutely impossible, to make them so, by hand. To attain these, and many other important ends, the slide-rest has been contrived, and has been long known to those who are acquainted with the manufacture of machinery and the processes in the finer kinds of work. There are still however, many ingenious mechanics, particularly in parts of the country which are distant from the larger towns or manufacturing establishments, who have no knowledge of this, and of many other modes of facilitating the nicer mechanical operations; and it is on this account that we have determined to make a few observations, as a preface to the description of the slide-rest of Mason and Baldwin. For turning rollers for flatting-mills, for cotton spinning machinery, and in fine, wherever true cylinders are wanted, a strong, straight bar, is employed, and along this, a slider is made to traverse, by means of a screw; in this slider, tools of various kinds may be firmly fixed, and carried along at pleasure. By a contrivance of this sort, *hardened steel rollers* are frequently turned, and many other similar operations performed, which would defy both strength and skill, applied in the usual way. By removing this sliding bar, to different distances, and also by shifting the tool, the diameter of the cylinder is easily regulated. Lathes are made for this purpose, which are not adapted to other uses, but the "American slide-rest," which we formerly described, and that which is now represented, are used on lathes of the common construction. Several others may be seen described in Dictionaries of arts and sciences, and in several European works, on mechanics in general, and in some, written expressly on the art of turning. Excellent instruments of this kind, are made by Maudesley, by Holtzapfel and Dyerlein, and by others in England. In the French, and other rose-work engines, they are indispensable, and have long been employed. Ornamental work, very similar to that upon many watch cases, can be performed in the common lathe, by means of an eccentric, or cycloidal chuck; but in this case, a slide-rest must be used. These instruments will hereafter be described, and figured, in this Journal, together with specimens of the work, performed by them.

Before dismissing this subject, we will remark, that in consequence of the firmness with which the tool is held, in the slide rest, and the accuracy with which it may be *fed*, and moved, there is no difficulty in turning articles which have projecting angles; a square bar, for example, may be rendered cylindrical, without the slightest danger of the tool *catching*. It is also applicable to the turning of screws of the most perfect accuracy, with but little skill on the part of the operator.

FOR THE FRANKLIN JOURNAL.

A DESCRIPTION OF
MASON AND BALDWIN'S IMPROVED SLIDE-REST.

(*With a Plate.*)

Fig. 1. Letter A. An iron Bracket, having a groove on the under side, to receive the head of a Screw-bolt. On the upper side is a small cylindrical projection, the top of which is a plane surface, forming a bed for the Base B, which is permitted to move round a centre bolt, and secured in any position, by the Nut C.

D. A Frame, (connected with the Base B, by the supports E E,) made perfectly flat on its upper surface, on which are secured two guides, F F, forming two acute angled channels, by which the main slide G, is retained in its place.

G. Main Slide, having two projecting tongues, fitted to, and sliding in, the above mentioned channels; whilst the flat portion of it rests upon the upper part of the Frame D.

Between the Guides F F, and extending in a parallel direction, is placed the Main Screw H, Fig. 2, passing through a semicircular Nut R, attached to the under side of the Main Slide, and supported by Bearings at each end, secured to the Frame D.

I. A detached piece of metal, set in between the tongue and the oblique side of the Guide, and adjusted to it by two small screws passing through the Tongue.

K. A semicylindrical covering, fastened to one of the guides, to protect the Main Screw H from injury by the chips or turnings. On the upper side of the Main Slide G, is a dove-tail groove, to receive the Cross Slide L.

M. Fig. 2. A Screw, by which the Cross Slide is moved; it passes through the Collar N, and works in a Nut Q, Fig. 2, fastened to the Main Slide, as in Figures 2 and 3.

P P P. Screws, by which the turning tool is secured to the Cross Slide L.

R. Set Screws, inserted in the Main Slide G, to adjust the Cross Slide L, (to which the tool is secured,) to any depth of cutting.

It is manifest, from this arrangement of the Main Screw, (which is completely protected from injury by chips or turnings, by the covering above described,) that the power is applied to the greatest advantage on the Main Slide, being in the centre of its guides; whilst the front, or that part of the Main Slide, where the tool acts, is better supported by resting on the Frame, than when overhanging, as in the Slide-rests in common use.

AN IMPROVED MILL-SPINDLE.

To the Editor of the Franklin Journal:

Sir—The gratification and benefit derived from your Journal, by mechanics, and their pioneers, the inventors, should, methinks, prompt them to communicate, in their turn, such improvements as fall within their observation.

In compliance with this suggestion, I subjoin a sketch and description, of a Spindle, for flour and corn mills, which, in some respects, will, I presume, be considered *improved.*

The drawing annexed is a Vertical Section, by which it will be seen that the outline is similar to mill-spindles in common use; but the body is larger, being usually of cast iron, about three and a half inches in diameter, and either round or octagonal, &c.; it is hollow, like a pipe, up to the Collar, by which distribution of metal, greater strength and stiffness are acquired, than if solid, and of equal weight. At the bottom, the bore is tapered upward several inches, which forms a socket for inserting a toe, which, if of wrought-iron, should be steeled at the point; a wrought and steeled Cockhead is also inserted at the top, in a square socket; or it may be tapped and screwed in. Both these points should be secured, by a screw, or pin, at the side, and a band should be driven on the lower end of the casting, to prevent splitting.

At the Collar, a small shoulder is formed, leaving the neck rather smaller than the body of the Spindle, but solid, or nearly so, in order to maintain the requisite strength. The Collar is made of any suitable metal, either cast or wrought, (I prefer the composition used in machinery, for inks,) with the bore large enough to go on the neck quite loose, and is then secured by filling the interstice with lead, or any soft metal; it may also be pinned.

The advantages of this Spindle, I conceive to consist in its greater strength and stiffness, as before mentioned, and that the wearing parts, while made of the most durable metals, are more readily repaired, or replaced. The cost of making, or repairing, will be less than that of a solid wrought-iron Spindle, of equal workmanship.

An objection common to this, with all cast-iron Spindles, will probably be made, viz. that a cast shaft, or spindle, although sustaining equal stress of torsion, with wrought-iron, of the same shape and dimensions, will yet be liable, from a sudden shock, to break and be useless; while the wrought-iron, in the same circumstances, would but twist, and so as to admit of repairing. To obviate this objection, I have introduced a cast-iron driver, of the usual form, and of such thickness as to bear rather less stress than the Spindle, that, in case of accident, (which very rarely occurs,) the driver shall break, and thus operate as a safety-guard to preserve the Spindle, and the other machinery.

I am informed, that, in Great Britain, it has been quite a desideratum, to prevent or reduce, the expansion of Spindles, which occurs from heat, generated by friction.

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MASON & BALDWIN'S IMPROVED SLIDE REST.

Fig. 1.

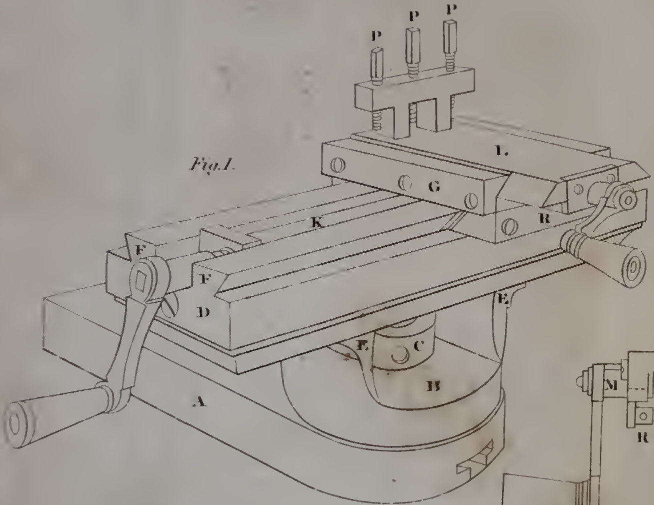


Fig. 3.

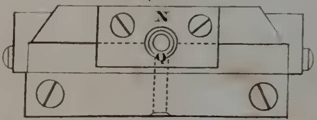
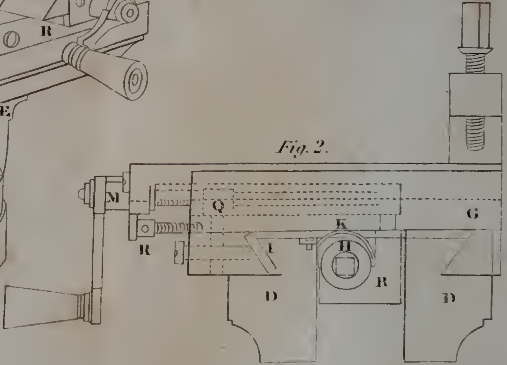
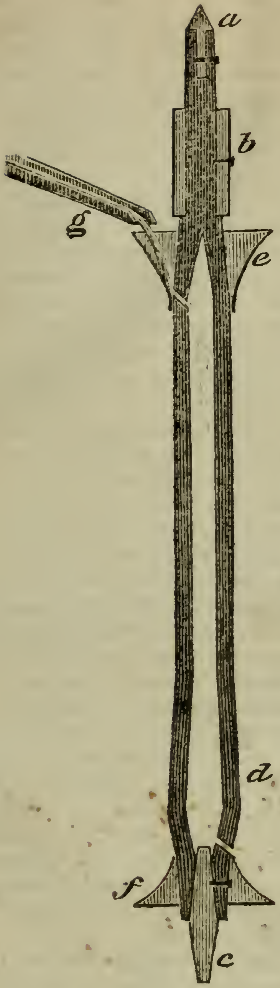


Fig. 2.



Geo. Strickland Del^t



I do not know that this object has been attained, and would suggest, that it may probably be effected in the following manner:

Let a funnel-shaped Rim be attached to the Spindle, just below the Collar, into which water may be conducted by a spout, and thence introduced, by a hole or holes, made in the Spindle, to its interior; the centrifugal force will probably spread the water over the interior surface, and the exterior surface may also be kept wet, if needful, by allowing water to pass between the Rim and the Spindle. The water may be thrown off the Spindle, by holes near the Toe, conducting it over an inverted Rim, fixed there. The effect of a constant stream of cold water, thus applied, must be to prevent expansion, or to render it nearly insensible.

BELIDOR.

a—the Cockhead.

b—the Collar.

c—the Toe.

d—a Square, or Cone, to receive a stone-pinion.

e—a funnel-shaped Rim, to receive water from the Spout *g*.

f—a similar Rim, inverted, to throw off the water.

Vicat on Cements.

A very excellent work has been published in Paris, entitled, "*Recherches Experimentales sur les Chaux de Construction, les Bétons et les Mortiers Ordinaires.*" By L. J. Vicat.

This work, containing many important facts relating to calcareous cements, and hydraulic and common mortars, is the fruit of an immense number of experiments, the results of which are arranged in

25 tables. These are preceded by a series of remarks and details, in which the general laws and effects are deduced and stated, but which lose the greater part of their value if separated from the tabular results. The following translations contain some of the results obtained by M. Vicat, and will give an idea of the importance of the work. It is only, however, by referring to the work itself, that a true estimate of its value can be obtained. [*Editor Lon. Mech. Mag.*

"*Trial of Lime-stones.*—It is of the utmost consequence, especially in public works, to ascertain the quality of the lime to be employed, and yet chemical analysis requires practice and knowledge which every architect does not possess. It is always more easy and certain to submit a fragment of the stone, which is to be tried, to common calcination in a lime-kiln, or, as we frequently do, with charcoal in a forge, (for coal forms clusters with the stone) than to slake it in the common way, and make a paste of it, which is to be placed at the bottom of a vessel filled with pure water. If, at the end of eight or ten days, this paste has become hard, and resists the finger, it is a proof that the stone tried, will furnish hydraulic lime; if, on the contrary, it remains soft, it has the character of common lime." p. 5.

"*To convert common lime into hydraulic lime.*—The operation to be described is a true synthesis, which, by the action of fire, unites, in an intimate manner, the essential principles which analysis separates from hydraulic lime. The lime to be modified is to be left in a dry and covered place, until reduced spontaneously into powder, and afterwards mixed by the aid of a little water, with a certain quantity of gray or brown clay, or simply with brick-earth, and this made into balls, which, when dry, are to be heated to the necessary degree.

"Common lime will require 20 per cent of clay; intermediate limestone will require 15 per cent; and 10, or even 6, will be sufficient for those which already possess hydraulic properties to a certain extent. When the quantity is raised to 33 or 40, the lime obtained will not slake, but is easily pulverized, and will make a paste that hardens very readily under water. When the clay is mixed with pebbles, &c. it is to be thrown into a large quantity of water, well mixed with it, and the finer part run off, into a convenient place. It may then be mixed with the lime in powder, and made into balls; the quantity required is easily ascertained by a little practice.

"It must not be supposed that the clay baked alone, and then added to common lime, in the proportions mentioned, will give the same results as when the two substances are mixed before being heated. The fire modifies the one substance by the other, and gives rise to a new compound, which enjoys new properties." p. 7.

"If fragments of common lime and a mixture of coal and charcoal be placed, stratum super stratum, in a small brick furnace and burnt; and if, as the substances fall by the dissipation of the combustible, the lime which passes through with the cinders, be returned with fresh fuel to the furnace, and the process be continued from 15 to 20 hours, according to the size of the fragments, an over-calcined lime will be obtained, which will not slake, but which, when reduced into a fine powder, and made into a ductile paste, has the property of hardening under water." p. 15.

On Slaking.—Quick-lime thrown into a proper quantity of water, splits with noise, produces a bubbling, liberates hot and slightly caustic vapours, and at last forms a thick paste. If a sufficient quantity of water has not been added in the first instance, to the lime, it is necessary to wait till it is cold before more be given. If a second portion be poured on whilst the lime is hot from the effect of the first insufficient quantity, then the lime does not divide well, but remains granular. This process is called *ordinary slaking*, or the first process.

"Quick-lime plunged into water for a few seconds, and withdrawn before it begins to split, then hisses, splits, and bursts apart with noise, and falls into powder. This powder, when cold, does not heat by the addition of more water. One part of lime, thus slaked, expands into 1·5 or 1·7 parts, by measure. This is called *slaking by immersion*, or the second process."

"If quick-lime be exposed to the air, it falls to powder, one part increasing in volume to 1·75, or even to 2·55. This is called *spontaneous slaking*, or the third process." p. 16.

"*Hydrates of Lime.*—Lime slaked in these three ways, was made into masses with water; these were dried in the sun, and then their resistance or tenacity, and their hardness, ascertained; and the result was, that for all kinds of lime, the resistance and the hardness were in proportion to the expansion in bulk by the process of slaking, that is, the process which divided the lime most completely, gave a hydrate of the greatest strength." p. 25.

"*Effects of Slaking on the Hydraulic Mortars.*—It appears, from experiments on the hydraulic mortars made from common lime, intermediate or meagre lime, and lime slightly hydraulic, that the three modes of slaking, arranged according to the order of their superiority, are the third, the second, and the first; but that for hydraulic lime, the order becomes reversed. If common lime be considered as the commencement of the scale, and we pass from that, through the various shades of difference, to the hydraulic lime, which is most meagre, and which will form the last degree on the scale, the differences resulting from the methods of slaking, diminish, at last disappear, and then increase in the opposite direction." p. 42.

"*Action of Water on Hydraulic Mortars.*—The dissolving action of water on hydraulic mortars appears to cease when it has removed the excess of lime that was either in weak combination, or entirely at liberty; and, it was found that the quantity which remained after the action ceased, was never far from that which had been ascertained to be the best; from whence the following: To find in all possible cases the proportion of lime which is most fit for any puzzolana, a ball of the hydraulic mortar, nearly an inch in diameter, must be made, having rather an excess of lime; this must be exposed for a year under pure water, which is to be changed frequently, and then the quantity of lime which has disappeared, is to be ascertained either by analysis or otherwise, and subtracted from the whole quantity, and the difference gives the proportion required for the quantity of puzzolana taken." p. 55.

"*Effect of Lime on Hydraulic Mortars.*—1st. Excess of lime in an hydraulic mortar retains its setting: the proportions most favourable to the setting, are also those which give the greatest strength.

"2nd. Powerful puzzolanas, combined with common lime, harden much sooner than if combined with hydraulic lime; but hydraulic lime has the advantage when combined with a less active puzzolana.

"3d. The second and third process of slaking, appear generally to accelerate the setting more than the first.

"4. Hydraulic mortars made with common lime, harden more, or make more progress from the second to the third year, than from the first to the second, so that it may be said, the rapidity of their progress may be accelerated.

"5th. The resistance of hydraulic mortars, made with lime slightly hydraulic, also undergoes an acceleration, but much less than in the former case.

"6th. The progress of mortars, made with lime eminently hydraulic, begins to diminish at the end of the second year.

"Hence hydraulic mortars, made with common lime, require more time than the others, to attain their maximum of resistance." p. 58.

"*On the nature of Hydraulic Lime.*—The modification which the action of fire has caused in the small proportion of silex and alumine, mixed with the pure calcareous matter, gives to the compound which results, the power of acting chemically by the intervention of water on the new siliceous substances added in the state of sand. It is this circumstance which constitutes the distinctive and essential character of hydraulic lime." p. 73.

"*On the use of Siliceous Sand.*—According to our results, the different sands arrange in the following order of superiority.

"For highly hydraulic lime: 1st, Fine sand; 2nd, sand of unequal size resulting from the mixture of fine sand, either with coarse sand or small gravel; 3d, coarse sand.

"For lime moderately hydraulic; 1st, mixed sand; 2nd, fine sand; 3d, coarse sand.

"For common lime: 1st, coarse sand; 2nd, mixed sand; 3d, fine sand." p. 74.

"*Rapidity of Desiccation.*—Mortars made from hydraulic lime, which have the power of solidifying all the water they contain, require to be dried slowly. They lose, according to circumstances, viz.—By common desiccation, three-tenths, and by rapid desiccation, eight-tenths of the force which they would acquire by slow desiccation." p. 77.

On Alloys of Cast-Iron with Lead, Tin, and Regulus of Antimony.

BY THOMAS GILL, ESQ.

Several years since, the Editor was consulted, by a type-founder, respecting the nature of a metallic alloy, which had lain neglected in his foundry for a long time, until, one day, being short of regulus, he was forced to endeavour to employ it to make type metal; he accordingly began to add lead to it, in the usual manner, but found it still unfit for use; necessity, however, compelled him to persevere, and he accordingly continued to add more and more lead to it, until it became nearer alike to type metal; *but it was not until he had employed twelve times the usual quantity of lead, that it became fit for use, and proved to be the best type-metal he had ever made!* This astonishing result led him to make the above inquiry; as, he said, the knowledge of the compound would have enabled him to make his fortune; the regulus being the most expensive article used in the type-metal. The Editor shortly afterwards mentioned this circumstance to the late celebrated Dr. Tilloch, the Editor of the "Philosophical Magazine," who said it brought to his recollection a fact that occurred to him many years ago, when he carried on the business of a stereotype founder at Glasgow. Having occasion to make type-metal, he put the lead and regulus of antimony into a cast-iron saucepan, and placed it over the fire, in a German stove, to gradually melt and unite the two metals, on his going to bed. *Next morning, on proceeding to take out his type-metal, he brought away nothing but the wrought-iron handle of the saucepan, and a ring of cast-iron affixed to it; the whole of the remainder of the saucepan, and its contents, having made their way through the fuel, and collected in the ashes under the grate. He did not, however, make any experiments with the alloy of cast-iron, regulus of antimony, and lead, thus accidentally formed.*

It has lately come to the Editor's knowledge, that, in a recent experiment, a mixture of lead and tin being repeatedly heated in a large cast-iron vessel, has at length made its way through the vessel, it remaining in the form of long masses, like icicles, adhering to the vessel. Now this circumstance throws great light upon the two former instances of the union of cast-iron with lead, under similar circumstances, although no tin was then present in the mixture; and it clearly appears to the Editor, *that the valuable mass of alloy first mentioned in this article, must have arisen from an accidental overheating of the cast-iron vessel, in which the type-metal was melted, as usual, in the foundries, and the iron thus entered into union with the lead and regulus of antimony;* and it may, therefore, well deserve a trial to endeavour to form such alloys, as substitutes for the regulus ordinarily employed in type founding.

It has also come to the Editor's knowledge, that frequently in lead works, the large cast-iron vessels employed to melt the lead in, have speedily become perforated by the lead, and rendered useless; nay, that it has become necessary, in order to prevent them from being overheated, to introduce a course of fire-bricks immediately under the bottoms of the vessels, and thus to prevent the direct action of the flame of the fire upon them; and this has been found to have the desired effect of rendering those expensive vessels more durable.

[*Technical Repository.*

Description of the chafingdish, or heater, employed for heating walls, or ceilings, which are to be saturated with a composition of oil and wax, or of oil and rosin, by the EDITOR.

In the *Journal des Connaissance usuelles*, for September, there is a plate and description of the heater employed when walls, &c. are to be saturated with the composition used upon stone and plaister, according to the process given in our last number. The construction of this heater, may be readily understood without an engraving. It may be made of sheet iron, and of any convenient dimensions; the form is that of a square box, which we will suppose to be 3 feet long, 2 feet high, and 6 inches deep, as this would probably be a good size for large surfaces. The bottom would, in this case, be 3 feet long, by 6 inches wide; the ends 2 feet by 6 inches, and the back 3 feet by 2 feet. The front consists of bars, made of large wire, and running across, like those of a common grate. There is a lid, or top, which is made to open, for the purpose of admitting the fuel. Near the bottom there is a grate for the fuel to rest upon, and under this, a space to receive the ashes. The top is made to fasten down, and to the centre of the back, is fixed a handle, by which the heater may be supported, so as to present its front vertically, against a wall, or horizontally, under a ceiling. Charcoal will be found to be the most appropriate fuel, both on account of its lightness, and its freedom from smoke. It will be best to light the charcoal before putting it into the heater.

In order to protect the hands from the heat in removing the heater from place to place, a large disc of any substance which is a bad conductor, may be fixed upon the handle, at the distance of three or four inches from the back of the instrument.

NOTICE TO EDITORS.

In availing himself of the labours of others, the Editor of this Journal has been anxious to give credit wherever it was due. In copying from Journals in which this rule is not observed, he has sometimes been unable to discover the original source of information, or it would always have been carefully noticed by him; whatever mistakes may have arisen from this cause, have been unavoidable. Some of the editors of Newspapers, are, either from wilfulness, or from want of care, guilty of injustice in this particular; nor are our foreign coadjutors exempt from the same fault. In the London *Mechanics' Magazine*, Dr. Hare's paper on specific gravity, has appeared without any indication of the article having been copied from this Journal. Credit has in another instance been given to '*Franklin's American Journal*.' We are aware that such omissions and mistakes result from inadvertence, and that nothing further is necessary, than to call attention to the subject.

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